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NOTE. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

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ORIGINAL ARTICLES

NEW THEORY OF SOLUTIONS.

> *"If the hypotheses at present accepted, and those set forth in the present investigation, should be found imperfect in the future, they will none the less have played an important part in having kept interest alive, in having served as a stimulus to experimental investigation and in being the result of attempts at perfect scientific reasoning".*
>
> (D. MENDELÉEFF).

The Chair of Scientific Investigation, with regard to the technology of agricultural industries, is carrying out under my direction a series of systematic investigations, directed towards finding a scientific basis for various problems of a practical nature which arise in the course of work in agricultural industries. Such was the origin and character of the present investigation for determining the laws which govern the process of crystallisation, a phenomenon of great scientific interest, which plays a very important part in industry generally and in agricultural industries in particular.

It is a well-known fact in the history of chemistry that the development of this science has received a fresh impetus and made very rapid advances since it has been possible to apply methods of weighing and volume measurement to various chemical phenomena. It is for this reason that research has been undertaken respecting crystallisation, a branch of science as yet so little known, by first attempting to find a means of measuring the phenomena which it is wished to place under observation in our tests. Many scientists have

sought a means of determining the processes of crystallisation, but none have so far succeeded.

The good fortune of finding a solution to this problem has fallen to our lot. After numerous experiments we have discovered *inter alia*, a fundamental law of crystallisation, which is as follows: the conditions under which crystallisation takes place being constant, the quantity of matter added to each unit of surface in unit time is always the same. Basing on this principle, a means has been found to estimate the rate of crystallisation and this phenomenon can now be measured with great exactitude in a very simple, expeditious and easy way.

In investigating any crystallisation phenomenon it is sufficient to measure a large number of similar phenomena and, on the basis of the measurement results obtained, general deductions may be drawn concerning the law which governs the phenomenon in question. This work requires a long series of experiments, which can only be carried out at the expense of much time and work; it also involves a series of complicated calculations. This work is now being carried on and the results are published from time to time. The results of these researches are, however, already quite assured and their completion is only a question of time. Only summary indications are given here, for the question of the rate of crystallisation is not the object of the present article. Those interested in the results of these investigations on the rate of saccharose crystallisation and in the methods applied in the present work are referred to the publications already issued on this question (1). In the present article it is desired to call the attention of the reader to another subject.

In the study of crystallisation there is another question of very great importance which has long since awakened the interest of the scientific world, and that is the question of the origin of the crystal, the causes which determine its formation. A whole series of complicated theories on this question are already known to science, and we will confine ourselves to briefly indicating their chief characteristics.

(1) See: *Le Moniteur de l'Industrie sucrière en Ukraine* [illegible] (The Sugar Industry Messenger in Ukraine); [illegible] *Zeitschrift* [illegible] Kiew" 1925, Nos. [illegible]; *Zeitschrift* [illegible] (Memoirs of the Chair of Scientific Investigation on the Technology of Agricultural Industries in Russia); Prof. I. Kucharenko, Kiev, 1914. pp. [illegible]

Certain men of science consider that the crystals are of spontaneous origin if the solution contains a sufficient quantity of matter capable of crystallisation. This is the physical and chemical theory. Others suppose that the formation of the crystals is dependent on the action of a mechanical agent on the matter contained in the solution, such as a shock, the shaking of the liquid, the action of mixing, friction, etc.; this is the mechanical theory. Others, finally, affirm that the origin of the crystals in solutions is determined by the presence of crystal embryons of the same nature as are found in the air; this may be termed the biological theory.

The tests made in studying this question show that, if the solutions of many substances are properly prepared so as to protect them against the admission of the crystal embryons in the air, the solution may be shaken and agitated at will, without crystallisation taking place, whatever be the quantity of matter dissolved in the solution; the same solutions, super-saturated, immediately crystallise in open receptacles, that is, as soon as the crystal embryons of the same nature in the air penetrate therein.

Let us take a solution of this kind, prepared with great care to prevent the penetration of the crystal embryons of the same nature in the air; if we succeed, while maintaining the same protection in concentrating the solution to the utmost, until there is nothing left after the complete evaporation of the water, but the total dissolved matter, and if we have at the beginning taken a sufficiently dilute solution, we shall obtain the dissolved substance in a non-crystalline form (amorphous or colloidal). As soon as this substance comes into contact, either through the air or in any other way, with crystals of the same nature, it will crystallise instantaneously; the phenomenon is accompanied with such an increase in heat, that generally the glass vessel in which the test is made, breaks.

Solutions of this kind were successfully prepared of a whole series of easily soluble substances, refractory to crystallisation, which were called *decrystallised*. There are certain less soluble substances, as for instance copper sulphate and others, which for a long time were not successfully obtained as decrystallised solutions; however, when sufficiently diluted solutions were taken for evaporation, decrystallised solutions were obtained, even for many substances which dissolve with difficulty.

The phenomena just described, as well as others previously

known, are not explained by the solution theories generally adopted by the scientific world. In order satisfactorily to explain these phenomena we have had to create a new solution theory, which will now be stated briefly.

According to our theory, crystalloid matter subjected to the action of water, detaches from its mass infinitely small particles, invisible under the microscope, which in turn undergo a series of gradual modifications. To simplify the matter two species of these particles are distinguished:

(1) the *crystallons*, which are infinitesimal particles, invisible even under the most powerful microscope, but which nevertheless retain all the characteristics of ordinary sized crystals.

(2) the *colloidons*, which are particles of the same dimensions as the foregoing, but which have lost the specific characters of crystals.

If a small quantity of a soluble substance be introduced into water, all the particles of this substance assume the form of colloidons; a dilute solution is then obtained which is for the most part governed by the laws discovered in the investigation of gases; these solutions differ in many respects from the denser solutions, and specially from the so-called saturated solutions. In evaporating a dilute solution, care being taken to keep it free from all contact with crystals of the same substance, a very dense and even saturated solution is obtained, but one which belongs to the species described as a decrystallised solution, because it cannot crystallise of itself, spontaneously.

If, on the contrary, at the outset, a larger quantity of soluble substance than is necessary to obtain a dilute solution, is introduced into the water, the solution will from the first contain not only particles of a colloidal form (colloidons), but also crystallons. The latter are so small that the most powerful microscopes do not reveal them, and the solution seems to be perfectly transparent. If this solution be then concentrated, even when all the necessary precautions are taken against the penetration of small crystals of the same matter, the solution will crystallise as soon as it has attained sufficient density; indeed, in this case the solution already contains from the beginning, crystallons, which possess, as has been said, all the qualities of crystals; consequently, at a certain degree of concentration of the solution, they may increase, detach other crystals from their mass, and thus cause the complete crystallisation of the whole substance contained in the solution.

Now, every theory must first satisfy two fundamental postulates: it must reasonably explain the known facts connected with a certain phenomenon, and allow facts still unknown to be foreseen by induction. Let us try to analyse our theory in order to see if it satisfies these requirements. It will be observed that our theory seems easily able to fulfill the first of these requirements. It explains, as we have seen, the undisputed fact that super-saturated solutions may be obtained for many substances, but which do not crystallise either if left at rest for a long time, or if subjected to the reaction of a mechanical agent; for this purpose it is sufficient to prevent them from being penetrated by crystals of the same matter from outside, as for instance in the atmosphere, which contains myriads of particles of all the substances known on the earth under the form of dust atoms, invisible even under the microscope. These supersaturated solutions crystallise instantaneously when they are no longer thus protected.

This theory also explains the formation of calcium oxalate crystals in the leaves of plants. The plant takes its nourishment from the soil in the form of mineral solutions. Before reaching the leaf these solutions pass through the plant vessels and traverse the whole organism. These solutions may therefore bring to the leaf crystallons of substances which dissolve with difficulty, among others calcium oxalate crystallons. In consequence of the chemical and biological processes which take place in the leaf, the calcium oxalate in the latter accumulates in the form of a very dilute solution. The internal cavities of the leaves are completely protected from all penetration by the small crystals in the air. Consequently, the formation of crystals in the leaf is explained by the fact that the crystallons of the respective substances are introduced into the leaf with the sap or nutrient solutions, by the plant vessels; it is these crystallons which cause crystallisation within the leaf, as soon as the solution has reached the necessary degree of concentration, owing to the evaporation of the water in the leaf.

The theory also explains the fact that sugar crystals are not obtained in the interior of the cells of the beet by drying the root, until all the water it contains has been eliminated. Indeed, sugar, being easily soluble, must exist in the root, before it is dried, in the form of a dilute solution containing no crystallons; consequently, if the water be eliminated by drying, supersaturated, decrystallised, saccharose solutions are obtained in the interior of the cells.

The theory also gives a possible explanation of earthquakes. It has already been seen that the crystallisation of colloidal substances is effected almost instantaneously and is accompanied by an enormous liberation of heat and an immediate increase in volume, which generally breaks the retort in which the test is made. Let us imagine therefore, within the depths of the earth, an isolated space filled with matter in a colloidal form, for instance, gypsum, chalk, etc. By infiltration from outside, crystallons of the same matter are brought by solution into contact with this colloidal substance. The result will be a violent transformation of this colloidal substance into a crystalline formation. The duration of earthquakes is very short and does not generally last more than a few minutes; but there will be an instantaneous increase in volume, an enormous release of energy, causing a great increase of pressure and temperature, with all the consequences attendant thereon.

By means of the theory can be explained the well-known fact that the temperature of the earth does not become lowered, in spite of the considerable loss of heat through radiation into interplanetary space. The explanation given of this fact is that, in the interior of the earth the process of crystallisation takes place uninterruptedly and causes a continuous release of energy and heat, which keeps the temperature of our planet more or less constant.

Finally, the theory enables us to explain a whole series of other phenomena, the knowledge of which is less widespread among the uninitiated, but which chemists and physicists have long since investigated; such as, for instance, the formation of a crystallised precipitate when certain perfectly clear solutions are mixed; the effect of friction on the walls of the vessel, which is sometimes sufficient to bring about the formation of a crystalline precipitate; the effect of boiling in order to obtain crystalline precipitates of slightly soluble substances; the necessity of applying to laboratories which already possess the same substance in a crystalline form, for the crystallisation of rare compounds not capable of spontaneous crystallisation; finally, many other phenomena, well known in themselves, but of which no uniform explanation could be so far given.

These details cannot be examined here, as that would lead us far beyond the limits of the present article, which is only of a preliminary character. It is hoped in the near future to devote a series of articles to a methodical and detailed account of these phenomena

and to their experimental demonstration, from the point of view of our theory.

Let us now try to subject the theory to a second test : does it allow the forecasting of certain phenomena hitherto unknown ? Before solving this question, however, the reader must be warned that it will unfortunately require a certain time before our forecasts can be verified. Every prediction may be confirmed or refuted only by future experiment, and ours are no exception to the rule.

If the theory is right, it may logically be deduced from the following :

(1) In laboratory tests two kinds of solutions may be obtained containing equal quantities of a dissolved substance, but which show certain differences in character (isomeric solutions), for the substance they contain will be in the form of different molecular states and the quantity of latent energy at their disposal will also be different.

(2) As dilute solutions are governed by certain laws relating to gases, it follows that when the decrystallised solutions are concentrated, they must deviate from these laws, nearly in the same way as do gases reduced by compression to a certain degree of density.

(3) There are certain substances difficult to render soluble for which decrystallised solutions cannot be obtained by treatment in the laboratory. The reason of this is that the weakened solutions contain these substances in such small quantities that it would be necessary to evaporate enormous quantities of the solution to obtain merely a few grams of the dissolved matter ; it is clear that this technical difficulty renders the operation almost impossible.

(4) Certain substances which are at present only known in their colloidal form and which are considered refractory to crystallisation, may be reduced to their crystalline form as soon as their crystallons have been discovered.

(5) The future elaboration of this theory should enable us to give a more concrete definition to the concept of " dilute solution ", by ascertaining exactly the degree of concentration to which these solutions should be reduced in order to acquire all their inherent characters.

(6) The degree of density at which the solutions acquire the particular qualities which characterise the weakened solution, varies according to the action of the properties which come into play, whether as dissolving or as solublilising principles.

(7) The total crystallisation of a solution decrystallised and

condensed up to supersaturation, is the effect of the reproduction of a crystal which has entered into contact with the solution by a process of division.

(8) According to our theory, science is wrong at present in considering crystallisation to be a process of molecular combination or a more complicated composition of the substance. From our point of view crystallisation is, on the contrary, one of the phases of decomposition. Its result is to produce substances of simpler composition, since in passing to that form they lose part of their latent energy.

We will confine ourselves here to the theses enunciated, though it is possible to deduce many other logical consequences from this theory, certain of which will later be practically applied to the various branches of human knowledge.

The future will also show to what extent our theory is in conformity with the truth.

At present efforts are being concentrated on a series of tests for the purpose of verifying to the utmost, all the principles devolving from our theory ; cooperation is invited in this work from all those interested in the question, the solution of which will help to verify our theory and further its development,

From the point of view of the theory, crystallisation cannot take place except in the presence of crystallons, which in turn are only particles, invisible under the microscope, of ordinary crystals. The earth's crust being composed of a vast number of crystalline substances, the presence of crystallons in the atmosphere and in all solutions of non-artificial formation is easily explained. But the difficult question which arises is to show the origin of the first crystals which, by their reproduction, have caused the crystallisation of such an enormous mass. For the present we have no other reply to this question than that generally given as to the origin of the first cell which originated all the plant and animal life of our planet, when, in an extremely remote past, of which we have scarcely any knowledge, the conditions of the terrestrial globe and other planets, favoured the spontaneous formation of the first crystals. At present these conditions no longer exist, at least on our planet, and crystallisation no longer takes place except under the influence of particles of other crystals of the same nature already existing.

In conclusion it should be added that in our opinion the theory of solutions, and especially that of crystallisation, is very important

for the future progress of science. I am personally convinced that the investigation of the structure of matter cannot be entered on until all questions regarding crystallisation have been elucidated. It is therefore indispensable to carry out this work, for on its results depend our future conceptions, more perfect than those now current, on the structure of matter. A deeper knowledge of these questions will doubtless mark a new stage in the progress of science.

Prof. T. A. KUCHARENKO,

President of the Chair of Scientific Research and Director of the Institute of Scientific Research on the Technology of Agricultural Industries, Kiev (Ukraine).

THE ELECTROGENETIC LABORATORY AT BELGIRATE AND THE METHODS PROPOSED BY ALBERTO PIROVANO.

The first Electrogenetic Laboratory was established last June at Belgirate, on Lake Maggiore, at the headquarters of the local Fruit Growing Society. Its object is to obtain new varieties of fruits by applying the methods discovered in recent years by ALBERTO PIROVANO for bringing about what he calls the *electric mutation of plant species.*

The Laboratory, of which a photograph is given of the machine room (fig. 1), was founded with the aid of the Ministry of National Economy, the Province of Novara and the Edison & Conti Electric Company, as well as by contributions from various Corporations and private persons, obtained by the special efforts of the President, Comm. A. FERRAGUTI. This Laboratory which is under the direction of PIROVANO himself is also to have its counterpart at Pistoia, which, as is well known, is a most important centre for fruit culture, and at Rovigo, where Prof. MUNERATI proposes to experiment with similar methods for raising new varieties of beet.

While the attention of practical workers is drawn to the creation of these Laboratories, the results of which cannot however be submitted to public opinion for some years to come, the student will find special interest in the experimental work of PIROVANO either as providing subject matter for future scientific research, or for judging whether the hopes of the practical workers are well founded or otherwise.

The results of his first experiments were set out by their author in a book (1) containing many very clear photographs and engravings; the later results, which have not yet been published, were observed by the writer in the nurseries at Vaprio d'Adda.

In the matter of genetics, ALBERTO PIROVANO may be said to be perfectly at home. Son of one of the most capable and esteemed nurserymen of Lombardy, a specialist in the production of table-

(1) ALBERTO PIROVANO, *La mutazione elettrica delle specie botaniche e la disciplina dell'eredità nell'ibridazione*. Milano, Hoepli, 1922, 268 pp., 114 figs. (The figs. are taken from the publication quoted by PIROVANO).

PLATE I.

FIG. 1. — Electrogenetic Laboratory at Belgirate.

grape hybrids, he has all the technical knowledge and enthusiasm which lead to success.

He states that in seeking to obtain striking and abnormal varieties, electricity forced itself on his attention as among the most likely means for achieving his object. In view of the difficulties of applying electricity to the female organ, and being also anxious that there should be no hindrance to the nutrition of the embryo which this organ should provide, he thought of applying electricity to the male organ, or pollen, in order through it to produce modifications in the primary cell (the fertilised ovum) from which the embryo originates.

In his book he describes the result of artificial fertilizations produced with pollen subjected in various ways to special electric treatment, causing a fundamental alteration of its constitution. Whatever the nature of this constitution, and it is not necessary here to follow PIROVANO in his speculations on the question, he calls *ionolysis* that alteration or *ionization* which, without killing, is obtained by radioactive or electromagnetic treatment. The forms of apparatus used by him, shown in fig. 1 reproduced above, are various, and may produce various effects.

With the object of subjecting the pollen to the action of radioactive substances, employing radium sulphate, he made use of the apparatus shown in fig. 2 annexed. The pollen must be placed at least ½ cm. from the radiating surface to ensure that the radiation is not too concentrated, but if stronger action is desired it can be placed, for a very short time, in contact or almost so, interposing the aluminium diaphragm in order to intercept the X-rays, which would destroy vitality in a few minutes. The pollen is placed in a thin capsule furnished with a movable septum, and the silver cover to which the radium sulphate adheres and which is attached to a thin ebonite slide R, is immediately placed thereon.

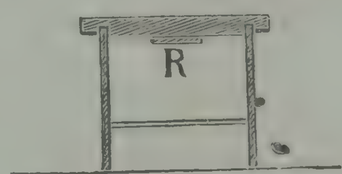

FIG. 2. — Apparatus for treating pollen with radium (full size).

In order to study the action of the ultra-violet rays, electric sparks are employed, the test being arranged as shown in fig. 3 annexed, or else the Cooper-Hewitt mercury vapour lamp is used, which is very convenient for ionizing the pollen but should be applied for a very short time.


FIG. 3. — Apparatus for treating pollen with ultra-violet rays produced by sparking (1/6 full size).

Ionolysis caused by varying the magnetic field is also very effective. It is always proportionate to the effect induced and is measured by the periodicity of the current and the duration of the exposure. The apparatus used for such application is shown in fig. 4. Two similar coils placed one over the other have a lamellar iron core, well insulated: one is fixed to the base together with its core which it barely touches at 1; it is not seen because completely surrounded by the secondary 1-10 mm. copper wire covering A., insulated with silk and coated with paraffin wax. The other, B, may be raised or lowered by turning the lever M, which controls the movement by a screw pivoting in a strong cast-iron stanchion firmly screwed down at the base. At C, an alternating apparatus enables the polarity to be controlled at P and P_1 according to the requirements of the case.

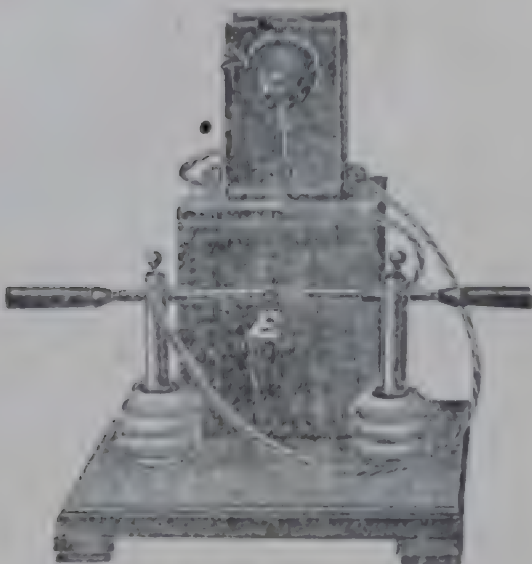

FIG. 5 — High frequency apparatus for treating pollen

Other kinds of apparatus, of which one is shown in fig. 5, are used to bring the pollen under the influence of a high frequency current.

All these applications of current actions are of limited duration and should be *adapted* to the particular species under treatment in which it is desired to bring about genetic modification.

The pollen of various species shows various degrees of resistance. That of the vine, for instance, which is very resistant under preservation is equally resistant to magnetic ionolysis at low tension, while, without losing its fertilizing power, it can no longer produce seed after being exposed an hour and a half to weak ultra-violet rays (fig. 6). Maize pollen also when ionolysed for a long period loses all fertilizing power (fig. 7). These are however exceptional results due to unsuitable or over long exposure to the action of the ionolysing agents, and when the duration or intensity is gradually reduced there are partial abortions, then developed seeds which do not however germinate, then seeds which germinate but give weakly and

PLATE II.

FIG. 4. — Vertical electro-magnet, especially adapted for intermittent currents for treating pollen.

PLATE V

Fig. 10.—Morphological anomaly in capsules produced by irregular rapid intermittent currents obtained with the electrolytic interrupter.

Fig. 11.—A curious carpellary proliferation phenomenon. From the apex of the ovary capsule, growing naturally, a new and strange corolla appears after the flowering.

FIG. [illegible]. — The "Zucchetta d'Italia"; a long green marrow.

FIG. [illegible]. — The "Zucchetta d'Italia", shortened, rendered more fertile and yellow by ionolysing at slow periods (1 plant).

PLATE VII

FIG. [illegible]. — Shortening of the fruits of the hermaphrodite plants and lengthening of the stalks caused by the pulsating magnetic field.

FIG. [illegible]. — A luxuriant and vigorous plant, produced by the rapidly alternating magnetic field photographed from above.

FIG. 16.

A
Lunaria biennis (Paragon).

B
Height reduced by ionolysing at slow periods.

C
Dwarfing produced by ionolysing at 500 periods.

PLATE IX.

Fig. [illegible]

Single wild pink mallow. [illegible]

[illegible] mallow, which reproduced true from the seed. A form produced by [illegible] in [illegible].

short-lived plants, and finally perfect seeds which give healthy plants, with some variations in their organs.

These last are important and should be discovered by the various methods. Their production depends on a complete combination of most delicate factors, on the choice, proportions and duration of which success depends.

In no other field is testing and retesting so necessary.

PIROVANO'S tests have hitherto been made only on annuals: *Papaver somniferum*, *Cucurbita Pepo* and its varieties, *Cucurbita maxima* and its varieties, *Althaea rosea, Lunaria biennis, Cheiranthus annuus, Helianthus uniflorus* and its varieties.

From the tests already made an idea may be formed, as PIROVANO says, of the fundamental variations that may be brought about by the action on pollen of the various agents tested. An examination of the numerous figures in the book and of numerous photographs not yet published, and above all of the material collected at Vaprio d'Adda, suggest that the method is one that may give abundant variations, constant, new, useful or otherwise, expected or unexpected.

Here, for instance (to give an idea of some of these variations), side by side with the normal double opium poppy with mature capsule (fig. 8) there is a deformation induced by slow magnetic ionolysis during a period of 4 days (fig. 9); a case of the persistence of petals due to the magnetic ionolysis of the anthers; a morphological anomaly in the capsule brought about by the irregular rapid interruptions obtained with an electrolytic interrupter (fig. 10); and a case of carpellary modification similarly brought about (fig. 11).

Here again, side by side with two normal Italian small marrows (fig. 12), a plant of the same variety which had been dwarfed and is rendered more fertile and yellow by slow periodicity ionolysis (fig. 13); one with dwarfed and twin fruits, with long peduncles, obtained by the action of a pulsating magnetic field (fig. 14); and one rendered dioecious and stalkless by a rapidly intermittent magnetic field (fig. 15).

Again (fig. 16), by the side of normal *Lunaria biennis* plants are those showing increasingly accentuated dwarf growth induced first by ionolysis at slow periodicity and then by ionolysis at 500 periodicity; and again two normal mallow plants, to the left, which reproduce themselves properly by seeds, obtained by the new hybridizing methods at low periodicity (fig. 17).

The results obtained with the new methods in hybridization are even more interesting. Tests were made on different varieties of poppies, marrows, tomatoes, sunflowers, altheas, cabbages, maize and peas.

It has become evident that it is possible, by ionolizing the pollen, to weaken at will the genital plasma of the species used as male and thus to displace the predominance in the hybrid of the characters of either parent.

For instance, whereas the hybrid obtained from the double opium-poppy with white flowers, fertilized with pollen from the double variety with scarlet flowers, has pale red flowers with white centred petals, by ionilizing the anthers of the male plant a hybrid with pale pink flowers is obtained, with a small percentage of white flowers, and by a stronger ionolysis, at 100 periods maintained for 6 hours, a hybrid characterised by the absolute disappearance of the red pigment is given.

Another example: by fertilizing the "pasticcina" variety of marrow (fig. 18) with pollen from the "portamantello" variety (fig. 19), a hybrid (fig. 20-*A*) is generally obtained, in the fruits of which the character of the fruits of the male plant may be said to be predominant; and yet if the pollen of the "portamantello" be subjected to from three to twelve hours of magnetic low periodicity ionolysis, hybrids are obtained, in the fruits of which (fig. 20 B and C) the predominance of the male characters is progressively reduced.

Similar results were obtained with tomatoes, maize, sunflowers, etc.

Sometimes the results were of the contrary order, that is, the ionolysis of the pollen brought out the characters of the male parent. These cases are also interesting so far as they are concerned with so-called *false hybridisation*, that is, that in which the male element, through lack of affinity with the female, does not unite with the latter but only stimulates the growth of the ovule; the embryo takes the character only of the species which serves as seed, and the seeds which come from it will give only weakly plants which make poor growth. In these cases the treatments proposed by PIROVANO strengthen the male element and true hybrids may be obtained in place of the false hybridisations.

This may be better explained by an example: *Cucurbita Pepo* var. *melopepo* (fig. 21) when fertilized with pollen from *C. maxima* var. *aureliana* (fig. 22) does not give a true but a false hybrid (fig. 23)

PLATE X.

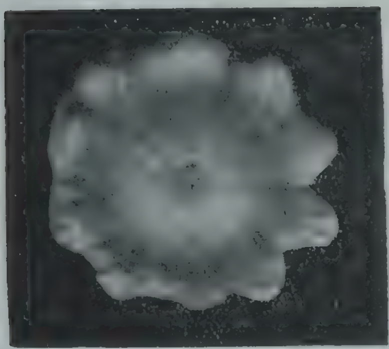

FIG. 18. — Marrow "pasticcina" ♀.

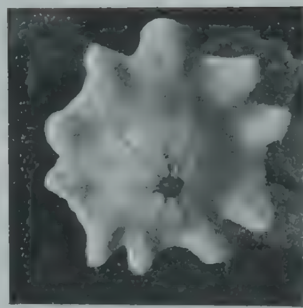

FIG. 21. — Marrow "pasticcina" ♀.

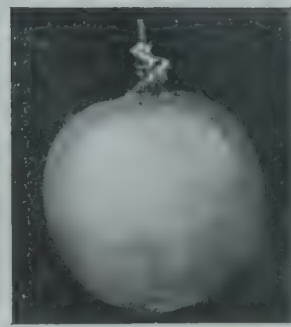

FIG. 22. — Marrow ♂. "Poor man's loaf".

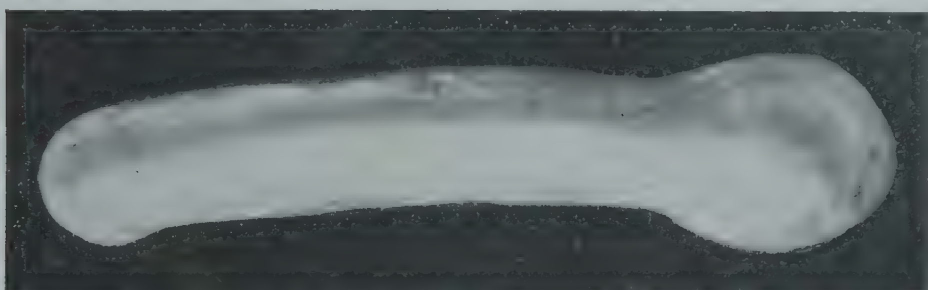

FIG. 19. — Marrow "portamantello" ♂.

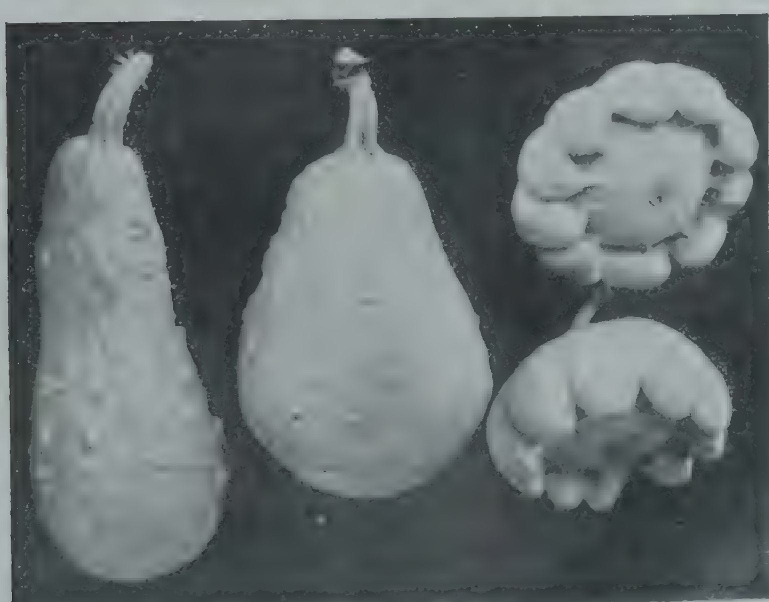

FIG. 20.

A
Normal hybrid.

B
After 3 hours' magnetic ionolysis at slow periods.

C
After 12 hours' magnetic ionolysis at slow periods.

PLATE XI

FIG. 23. — Foreign hybrid (false hybridization) reproducing the maternal species, considerably reduced and atrophied.

FIG. 24. — The hybrid, however, contrary to the rule, tends towards the male species.

PLATE XII.

FIG. 25. — Marrow "Italia Paragon". Each plant yields 1-2 very large fruits and hundreds of male flowers.

Plate XIII

Fig. [illegible] — [illegible] from hermaphrodite fruit, obtained in F_1 by treating the pollen at 600 periods. Leaves large, few; fruits, flowers and buds, together number 10. The sexuality seems to have a Mendelian character; indeed, the sex male prevails when the pollen is ionolysed.

in which are reproduced, considerably reduced and atrophied, the characters of the maternal species. If on the other hand the pollen of the male species is subjected to an intermittent magnetic field (42 periods) for 3 hours, or to a pulsating magnetic field with a current at 83 volts for half an hour, a true hybrid (fig. 24) is obtained, the characteristics of which are nearer the paternal species than those of the normal hybrid produced with natural pollen.

A final and interesting observation was made last autumn at Vaprio d'Adda. Several beds in which the Italian marrow had been cultivated were literally covered with the fruits of this plant, in such abundance as perhaps had never been observed before.

Normally this marrow gives one or two very large fruits per plant and hundreds of male flowers (fig. 25). By ionolizing the pollen at 600 periods PIROVANO obtained seeds which gave extraordinarily prolific plants, on one of which (fig 26) the fruits and female flowers and buds numbered 19, the male flowers having almost entirely disappeared.

As already stated in another case (fig. 15) the formation of dioecious plants took place, as a result of ionolysis, with the cucumber, which is a monoecious species. In this connection PIROVANO observes that sexuality seems to behave almost as a mendelian character, and in fact as in the majority of hybrids, by the ionization of the pollen the female sex became predominant (1).

What are the conclusions suggested by the above?

If it is impossible to accept PIROVANO'S hypotheses as to the nature and constitution of the living plasma and the nuclear chromosomes, which is one of the most difficult, most disputed and most obscure problems of biology, and as to the mode of action of electricity, it must be admitted that the results of his experiments are undoubtedly of scientific interest. This interest depends not so much on the production of so many forms, many of them quite abnormal, thus recalling those obtained similarly with certain animals, as on the results whereby varieties, which are normally otherwise, are rendered hybridisable, and on the modification in the hybrids of the distribution of the characters of the parent forms. The influence also shown over the manifestation of either sexual form is deserving of the

(1) Mention may here be made of the experience of CIESILSKI at Lemberg, who remarked that in hemp the predominance of the male sex was obtained by pollinating with young and perhaps immature pollen. It would be interesting to see the effect of ionolysis on this pollen.

utmost attention, and the student cannot fail to be interested in the results obtained.

As regard practical applications PIROVANO himself states that it is as yet premature to make any forecast for the future.

His tests, as has been stated, have up to the present been made only on annuals. Those on fruit-bearing plants were begun this year only at Belgirate, with pollen that he had ionolysed in his Laboratory at Vaprio d'Adda ; it is necessary to wait until the seeds thus obtained develop new plants and see whether and what variations take place which are worthy of being preserved and multiplied or otherwise.

There is here however a new method for creating variations and a careful study of the manner and degree of applying the method to the species may give important results. Such results are specially likely to follow on the treatment of hybrid forms, through which, as PIROVANO affirms, it is more than probable that with suitable means, it may be possible to control in the widest sense genetic heredity and subordinate it completely to the human will.

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VINE-GROWING AND WINE PRODUCTION IN RUSSIA BEFORE THE GREAT WAR AND AT PRESENT.

History of Russian vine-growing.

The history of Russian vine-growing is as singular as the whole history of Russia. Russian wine production, compared with that of Europe, is as new as are the State and culture of Russia compared with those of the countries of old Europe.

The slow development of this industry in Russia is explained by the history of the regions of the South, which may here be recalled.

Russia as a State began to form, little by little, a thousand years ago, starting with the Northern and Central regions.

The last three centuries, the XVII, XVIII and XIX, were the period during which Russia definitely assumed her natural area, pre-indicated by the extent of the great Russian plain, which stretches from the White Sea to the Black Sea and eastward to the boundaries of China, Tibet, Afghanistan and Persia. During the course of these three centuries Russia has increased in extent principally in the south, where the vine flourishes. Previously there was no region for this culture. The history of the South Russian provinces is that of perpetual and permanent warfare between the neighbouring peoples and the various Asiatic tribes which always passed that way in their march westward. The Russian steppes to the north of the Black Sea became deserts after the invasions of the Goths (III century), the Huns (IV & V c.), the Kasars (VII c.), the Prechenegs (IX c.), the Polovtzis (XI c.), the Tartars (XIII c.) and finally the Turks (XV c.) until the colonisation of these steppes by the Russians, emigrating again from the north to the south.

The formation of the Muscovite kingdom, already powerful and populous, enabled these colonisers of the South to establish themselves there firmly, as far as the shores of the Black Sea and the northern Caucasus.

The numerous wars of the Russian Empire with the Turks in the XVII, XVIII and XIX centuries, sustained and fixed them in these new territories. Only in the XIX century, when Transcaucasia and Central Asia were added to Russia, did these southern regions begin to develop their vine growing, which had till then remained in a primitive state.

The regions of the South, especially Transcaucasia, were the universal cradle of the vine and wine production, for Noah, the first man who, according to the legend, fermented the juice of the grape, landed from his ark on Mount Ararat, in Armenia, and commenced to engage in viticulture.

The Transcaucasian viue growers at the beginning of the XIX century had not progressed much in this culture since the time of Noah, on account of the continual wars at this point of passage from Asia to Europe. Nevertheless, primitive viticulture spread there.

In Crimea, Bessarabia and on the shore of the Sea of Azof, vine growing was first introduced by the Roman and Greek colonisers (VII and VI centuries B. C.) and afterwards in the XIII-XV c. A. D. by the Genoese, who taught the natives the care of the vine and wine-making. The domination of the Turks in these regions since the XV c. has completely destroyed this industry on the shores of the Sea of Azof and greatly retarded it on those of the Black Sea.

The Southern provinces of Russia, as they existed in 1924, where viticulture was already extensive at the beginning of the XIX c., were annexed to Russia in the following periods:

Astrakhan	in the XV century
Don	" " XVI "
Northern Caucasus (Kuban, Terek, Stavropol)	" " XVII-XIX c.
Crimea	in 1783
Bessarabia	" 1812
Transcaucasia.	from 1801-1878
Turkestan (Central Asia) . .	" 1864-1885

When these countries were annexed to Russia, viticulture existed in a primitive state in Bessarabia, Crimea, Transcaucasia and Turkestan (only table grapes). In the others only vines reduced to a wild state remained.

The first steps in the development of Russian viticulture pro-

perly so called, were made by Czar Michael Theodorovich, at the beginning of the XVII c. at Astrakhan.

Later, when Czar Alexis Michailovich heard that the first Russian colonists on the banks of the Terek (Northern Caucasus) had found the wild vine there, he sent them vine-growers and plants from Astrakhan in order also to introduce viticulture.

In 1720 Peter the Great developed this culture on the Terek by sending Armenians, formerly wine-growers, there as colonists. In 1736 two fortified towns, Mozdok and Kizlar, were founded on the Terek, and with the aid of the Armenian and Georgian colonists vineyards first spread around them and afterwards along the banks of the Terek.

Thus was the interest of the Russian Government in vine-growing first shown. But viticulture did not begin to assume much importance in the economy of the country until the middle of the XIX century. Until then each viticultural region of Russia consumed its own produce and remained in a primitive state as regards labour.

At the end of the XIX century Russia attained its natural limits. Then only, protected from foreign invasion by its military power, did it commence to develop in agriculture and also wine-production. Under the protection of the Great State, safeguarded from the wars and invasions of enemies, the Southern provinces engaged in agriculture, and everywhere interest was aroused in the vine, thanks to a propitious soil and climate.

At the beginning of the XX century, agriculture, the principal and most important economic element of Russia, was already well advanced. The Great War and especially subsequent events have arrested its progress.

It is evident therefore that Russian viticulture cannot have a long tradition of its own nor distinctive types of vines, even in the provinces which have cultivated the vine for centuries.

In the middle of the XIX century when there were not yet enough railways in this vast country, each of the wine-producing provinces, distant from one another, from the Centre and from Europe, retained its own altogether primitive methods of wine-production.

In all these provinces viticulture developed and progressed only after the construction of a railway, which connected it with the crop-growing centres of the country.

The European, and especially French viticultural tradition, then commenced to influence this branch of Russian agriculture. As there

were no specialists trained for this work in Russia, the German, Italian, and especially French wine-growers penetrated to these provinces, brought thither on the initiative of the Government and the large proprietors. The first European pioneers in this work were not, unfortunately, the highest specialists of their country, for Russia, considered in Europe as being still too backward, did not arouse the interest of the great wine-producing masters.

At this epoch one often found in Russian cellars or vineyards, foreigners who had formerly been school-masters, barbers, or even cabmen, who gave themselves out as great specialists in European wine production and who directed the work according to their own fancy and made ignorant people believe in their profound knowledge.

Owing to their mistaken proceedings in the beginning, Russian viticulture did not start well. Continued relations with Europe and the great progress made in all branches of Russian agriculture at this time, have however changed viticultural conditions.

Russian literature on this subject has become important. Much sound tradition, mostly French, and several original works by Russian specialists, already trained in this work, benefited and extended the development of knowledge of viticulture and wine production among wine-growers and proprietors, while, in the south of Russia, œnological schools prepared a staff of specialists in this industry.

The first Russian school of viticulture was founded in 1783 in Crimea, at Sudak, and in 1912 it was transferred to Magarach (near Yalta) by the Duc de Richelieu and reorganised. This original school still exists and about the year 1900 became a training school with a sound theoretical and practical course, an œnological station, a cellar and an experimental vineyard.

Another oenological school was founded at Kizlar (in the Terek district) in 1807.

These schools were the pioneers in modern European technique for viticultural work in Russia but left, however, still much to be desired.

Towards 1914 there were already a dozen œnological training and preliminary schools, without reckoning provisional preliminary courses, wine-growing stations, etc. In Bessarabia and the South-West provinces there were 2, in Crimea 1, in the Northern Caucasus and the Don 5, and in Transcaucasia 4. In several Russian agricultural and technical schools special wine-making courses have been opened. At the school at Magarach, higher courses in wine making lasting

two years have been organised. Besides these schools, knowledge of viticulture and wine-production was widely disseminated among the people through the agency of agronomists, specialists at the Ministry of Agriculture, who had formed in the districts of the South, Associations for the introduction of American vine-stocks, œnological laboratories, and temporary courses.

The practical and independent wine-producing organisation of the Imperial Dependencies, which had its vineyards and cellars in nearly all the Russian wine-producing areas and local wine depots in all parts of Russia, was the principal source of information on viticulture and wine production in the Country, owing to the example it set of practical and modern work, perfecting the staff, spreading a knowledge of the technique of the work among the neighbouring peoples, educating the taste of the consumer, and seeking out the typical wine of each viticultural region.

The practical work of the Dependencies and the theoretical and instructional work of the Ministry of Agriculture were the two principal motive powers in the serious development of the work in the Russian vineyards during the course of the last 30-35 years before the Great War.

Many of the owners of private estates, already vine growers and wine connoisseurs, brought their work into harmony with that of the great organisations. The Zemstvos (autonomous administrations of districts and provinces) have also helped much in this development, especially in Bessarabia and Crimea.

At the beginning of the XIX century Russian wines were simply called after the names of the provinces from which they came : the Don, Crimean, Bessarabian, Kakhetian and Kizlar red and white wines. No distinction was made as to vines, and still less as to vintages.

About 1870-1890 the wines began to be subdivided according to the vines, and it became the custom to call them by the names of celebrated European growths : Bordeaux, Barsacs, Sauternes and Rhine wines were sold, which came from all the viticultural provinces of Russia. Doubtless this custom originated with the first foreigners who directed Russian production. Nevertheless, at this time nearly everywhere the French and Rhenish technical methods began to be used more or less efficiently.

Prince M. Vorontzoff was the first great pioneer in this Russian industry, which he improved in nearly all the provinces. Russian

specialists perfected themselves in France and on the banks of the Rhine, and the foreign staff in Russia improved. It was already known how to distinguish and choose wines, and Europe began to be interested in Russian viticulture.

Prince Leon Galitzin, a great wine connoisseur, brought up in the French vineyards, began to reorganise the wine production of the Dependencies and of his own estates. His successor was M. A. Merle de Massoneau, a Frenchman and a great wine specialist and first-class taster, who trained an entire generation of Russian wine producers and specialists and directed the whole of the wine-production work of the Dependencies in all the Russian provinces for more than 20 years. He taught them French tradition and technique, educating their taste and perfecting the standard of work. M. Bobiney, a man learned in French wine production, was a collaborator in the Dependencies, directing the work in connection with sparkling wines at Abraou. V. Thiébaut, M. Dravigny, G. Barberou and many other French specialists have contributed their experience and technique to this work. Their Russian pupils, often after a long residence in France, Spain and on the Rhine, and with good practical experience gained in Russia, have become their successors and carry on the best traditions of the wine industry.

Only towards 1890 did wine production in Russia enter into the right channel, directed as it was by the practical wine production organisation of the Imperial Dependencies and the administrative and instructional efforts of the Ministry of Agriculture.

The producers have learnt how to differentiate the various Russian growths. The Dependencies have given special numbers to their wines. Everybody in Russia then knew Nos. 18, 22 and 24 of the Dependencies, which were a definite and constant type, of genuine flavour, well prepared and old.

About 1900, each of the Russian viticultural districts had shown the possible type of its wine. The native growths were then named after the localities producing the best wine of each district.

Throughout Russia the wines of the following districts are known and appreciated: Livadia, Massandra, Aluchta, Alupka, Sudax, Abraou, Anapa, Gelendrix, Naparçuli, Tzinondali, Teliani, Muxusani, etc. This was the natural and final object of the elementary development of wine-production technique and of the investigations on original Russian wine types.

In Russia, doubtless, we have no wines corresponding to the great

French growths, but there are certain localities which produce wines of the best quality, correctly treated, full-bodied, with bouquet, bright, and matured in the proper way. The collections of old wines from the Dependencies and other large estates in the Crimea, Georgia and Abraou were a proof of this.

The Russian regional wine type has now been generally found for most of the provinces. Time and continuous work are necessary to make it known and bring it to final perfection. Nor are five or ten years sufficient ; it will require decades, and experimental investigation on Russian wine production and the efforts of their French masters to accomplish this work.

We now know, in a general way, what can be done with the vine products in each district of Russia, without trying to reproduce everywhere all the possible types of European wines.

Three fourths of the Russian vineyards were small estates (less than 5 hectares), and one fourth large estates, the pioneers in wine-production technique.

Before 1914 the total value of the production of the Russian vineyards reached the figure of 80 million gold roubles per year. The vineyards produced an average of 2 ½-3 ⅓ million hectolitres of wine.

The export and import of wine in Russia before the war was, in gold roubles :

	1907	1908	1909	1910	1911	1912
Export.	545,983	201,831	187,038	170,802	184,956	53,000
Import.	9,524,918	11,384,163	10,916,317	11,516,095	12,368,522	11,574,000

The exported wines went chiefly to China, Persia and Germany, and gradually decreased, whereas importation increased, in spite of the development in local wine production, this being due to the large increase in the consumption of good wine in the large towns.

FIG. 17. — Map of Vine Growing Areas in European Russia and the Caucasus.

M = Moscow ; R-M = Roumania ; B = Bucharest ; K = Constantinople ; T = Asiatic Turkey ; P = Persia ; 1 = Black Sea, 1 A = Azof Sea 2 = Caspian Sea ; a = Scale in versts (150 versts = 160,002 klm.) c = rivers ; d = cities ; e = vineyards ; f = frontiers.

FIG. 28. — Map of Vine-Growing areas of Russian provinces of Central Asia.

T = Turkey; P = Persia; A = Afghanistan; C = China; RS = Russian provinces; x = scale in versts; a = railways in exercise; b = railways in construction; c = rivers; d = cities; e = vineyards; f = frontiers.

The production in Russia before the war was, per district :

Provinces	Area of vineyards in ha.	Total grape yield in kg.	Average yield per ha.	Total production of wine in hl.
Bessarabia	66,596	60,800,000	1,120	424,070
Crimea and Ukraine	32,440	59,600,000	2,002	220,962
Astrakhan	552	3,452,000	6,800	369
Northern Caucasus:				
Don	12,580	28.371,200	2,304	77,428
Kuban	8,376	18,331,200	2,400	52,102
Stavropol	5,819	69,065,600	12,928	409,995
Terek	11,825	31,081,600	2,880	186,529
Eastern shore of the Black Sea	950	2,945,600	3,344	20,418
Turkestan	27,391	61,344,800	2,239	29,052
Transcaucasia	84,175	211,776,000	2,515	954,775
Total for Russia	250,704	555,768.000	—	2,375,700

It should be noted that these statistics (from the Ministry of Agriculture) are not exact and are mostly greatly below the actual figures for viticulture and wine production.

In the majority of the provinces it will be noticed that only the smaller part of the grape yield is transformed into wine.

This proves that local wine production has not yet reached its highest point everywhere. As an illustration of this, the following is a table showing the percentage of the grape yield transformed into wine per province :

Eastern shore of the Black Sea	90.1 %	Kherson	47.1 %
Bessarabia	78.8 "	Tauride	46 "
Terek	78 "	Sukhum	43 "
Stavropol	77.2 "	Zaxatali	39.8 "
Daguestan	70 "	Kuban	36.9 "
Tiflis	64.1 "	Don	34.9 "
Erivan	62.7 "	Baku	26 "
Podoli	58.8 "	Batum	16.6 "
Elisabetpol	54.1 "	Samarkand	7 "
Kutaiss	54 "	Kars	5 "
Ekaterinaslav	51.6 "	Fergana	2 "
Syr-Darya	47.5 "	Astrakhan	1.4 "

In certain districts a low percentage shows that the principal production is the table grape (in Baku, Batum, Samarkand, Fergana, Astrakhan), and in the majority of cases implies the local consumption of grapes and household wine. This means that their vine production is too extensive. The Eastern shore of the Black Sea, where the whole of the grape yield is transformed into wine, shows only a normal percentage, 90 %. This is one of the latest Russian wine-producing regions where the work was started on a scientific basis from the commencement, dating from the Russian colonisation after 1865.

The State of Vine Growing and Wine-production in Russia in 1924.

The great viticultural district of Bessarabia was separated from Russia and annexed to Rumania (1918).

The other viticultural provinces, with the exception of Transcaucasia, were the theatre of war from 1918 until 1920.

Unfortunately, there are no exact and complete statistics on this question, but the data I have been able to collect give au idea of the present state of this industry in the Union of Soviet Republics now forming Russia.

At the beginning of the Bolshevik regime (1918-1919) the sale and consumption of wine were entirely forbidden, and the cellars containing large reserve stocks were emptied. Only in some places (Fillis, Abraou and the South Crimean shore) did the large depôts old wines remain intact, and these were gradually sold and consumed. The vineyards were abandoned and their area reduced each year.

The civil war was waged chiefly in the viticultural provinces, and this could only have a disastrous effect on the industry. Transcaucasia, the least devastated region, which, until 1921, had been under the autonomous regime of the Georgian, Armenian and Adjerbeijan Republics, more or less maintained its viticulture and wine production. But towards 1923 this industry was destroyed through the ravages of phylloxera, the lack of material for treating the wines and the new economic methods of the Bolshevik régime. In the whole of Transcaucasia, Daguestan has suffered most. According to the data of the Bolshevic Commissariat of Agriculture, wine production in Daguestan fell to one-tenth in the last years before 1921. Near Derbente and Petrovsk the vineyards dwindled away on

tens and hundreds of hectares. The Daguestan Viticultural Department states (1921) that after 1-2 years, under present conditions, "*nothing but stumps*" will remain of the local vineyards... (SHEFLER, "The Soviet Central Department of Agriculture and Economics, under the new economic policy". Official edition).

As the economic conditions did not improve towards 1923, it may be estimated that at the present time viticulture in Daguestan has completely perished.

The area of these vineyards must now be deducted from the total area of vineyards in Transcaucasia.

Viticulture in Turkestan towards 1922-23 suffered from the general economic conditions. A Soviet Official Commission which investigated the state of the Province of Fergana in 1923, reported to the Central Labour and Defence Committee as follows. Seventy per cent of the irrigation system existing before the war has been destroyed. Land under irrigation has decreased from 1,068,200 ha. to 343,350 ha. (1/3 of the pre-war area). Even now 80 % of fhe irrigated land is unsown. Only 15 % of the 1917 area of cotton plantations remains. The diminution of labour and especially of livestock (reduced by 58 %) impedes agricultural work (The "*Dni*" newspaper, No. 392, 21 November 1924). Under these circumstances viticulture cannot prosper. The greater part of these vineyards must have perished. In the whole of Turkestan at present scarcely 10,000 ha. remain, instead of 25,000 ha.

The same official publication (Pod redasctiej M. Shefler Centralnoïé Oupravlénié Zemlédelija i Sovietskili Khoziajsfi v sviété novoï ekonomischeskoï polititci Isd. Narodnogo kommissariata Zemlédellija), states: "In 1921 viticulture in the Crimea, the least affected of all the districts, underwent a severe crisis through being unable to dispose of its grapes and wine. It would require an enormous amount of work in organisation and immense sums of money to save this industry from complete ruin and to restablish it as soon as possible over the area it occupied before the war..."

The Soviet newspaper "Sbornik statistitchesko ekonomischeskoï svedenij po sielskotchosiastron Rossin" publishes disquieting data on the years following: towards 1922 the vineyard area in the Crimea had diminished by 1526 ha., and the yield, instead of being 2,400 kg. per ha. as it was in 1916, had fallen so 400 kg. The same paper (No. 89), estimates that the total vineyard area in Crimea in 1923 is 5,450 ha., and that the yield had risen to 1020 kg. per ha. But the

selling prices of wine, 2.75 to 3.75 gold roubles per vedro (12.3 litres), were below the cost of production.

As in case of viticulture, all the other intensive crops were equally threatened:

	1916	1922
Fruit-trees . . .	13,625 ha.	10,082 ha.
Tobacco	4,812 "	504 "
	yield:	
	3,360,000 kg.	320,000 kg.

The fruit output was one-tenth (480 kg. per ha. instead of 4,800 kg.). That of 1923 was much better, but exportation could not be organised and the greater part rotted on the spot.

" ... To maintain all these intensive crops in Crimea, *even under present conditions*, a State subsidy of 1 million gold roubles is needed..." (*Economic Life*, No. 89). It is certain that in 1923, there was serious deterioration and reduction of viticulture in Crimea, formerly the most advanced area of Russian viticulture.

In 1921 the Ukrainian vineyards were perishing from the attacks of phylloxera, 3,815 being attacked at that time. (SHEFLER, *ibidem*). The lack of financial means and of a serious campaign against this disease leads to the conclusion that the losses in local viticulture have been still further increased, and at the present time it is estimated that not more than barely 20,000 ha. of vineyards can remain in Crimea and Ukraine, instead of 32,440 ha. before the war.

Viticulture in North Caucasus (the Don Cossack, Kuban and Terek districts and the Province of Stavropol) has suffered during these last years more than that of the other districts. " In the Province of Stavropol in 1920 only 1,000 ha. were harvested... and about 5,000 ha. of vineyards there were not earthed over for the winter and have been frozen" (*Ibidem*).

In 1922 viticulture completely perished in the Province of Kuban. There remain only small areas under the grape, utilised for domestic purposes. Vineyards are also diminishing in the Black Sea Coast Province. Soviet statistics furnish the following figures (" *Economic Life*", 15-III-23):

	1912 ha.	1922 ha.
Kuban	7,194	—
Shore of the Black Sea . . .	2,158	981-566

Of the 981 ha. still remaining in the latter province, only 500 ha. are cultivated and productive.

The total area of Soviet vineyards, according to my calculations, in 1924 is:

	Before the war — ha.	in 1924 — ha.
Transcaucasia	84,175	80,000
Turkestan	27,391	10,000
Crimea and Ukraine	32,440	20,000
The South-East (North Caucasus, Don, Astrakhan and Stavropol)	40,102	13,000
Total	184,108	123,000

That is to day, the general area of Russian vineyards has diminished 33 % on pre-war figures.

The Soviet data which on the whole correspond with my estimate and only vary in details, show a still higher percentage of loss.

At the Exhibition of the Federation of Soviet Republics held at Moscow in 1923, official figures were published showing the vineyard area per province in thousands of ha.:

Provinces	Before the war	in 1922
Ukraine	34.8	4.3
Crimea	9.2	2.6
Don	13.0	4.3
Turkestan	24.0	21.4
Astrakhan	1.0	0.3
North Caucasus and Daguestan	28.7	17.0
Transcaucasia	105.7	85.0
Total	216.4	134.9

About 1922 81,500 hectares perished, being 37.5 % of the total vineyard area.

There is no doubt that this loss is rather under than over-estimated and by 1924 has undoubtedly increased owing to the ravages of phylloxera and to the state of the agricultural economy of the country.

The present vineyards as shown by these figures are not in a normal state. Vineyard area and cultivation have much diminished in recent times. A low estimate would give 50 % only as being in a normal state, the others having lost most of their quality and especially their fruit-bearing capacity.

We see, then, basing on the Soviet figures, that the remaining vineyards in Soviet Russia should be divided into two classes :

fruit-bearing.	67,800 ha.
abandoned and new (or restored) . .	67,800 "

The book already quoted (SHEFLER, *ibidem*), gives a general idea of the situation of Russian viticulture about 1921 : "... The war, the blockade and the abolition of the wine trade have greatly harmed agricultural economy, and especially viticulture and wine-production. " The prohibition of the sale of wine, its expropriation at a fixed price or even without payment, and, in some places, the absolute prohibition of wine-production, have placed the growers in an inextricable position, for they depended financially solely on the sale of wine to the State and to private buyers. There remain neither financial resources nor other means to continue this industry. The bitter civil war in these regions still further increases the ruin of viticultural production " (*ibidem*, page 96).

This official publication of the Commissariat of Agriculture suggests a project for the restoration of Russian viticulture. Recalling and approving of " the work done by the Dependencies and the former Ministry of Agriculture, for the improvement of Russian wines "... this Commissariat finds that " with great energy and State aid, wine production in the Soviet Federal Uhion can yield at least 2½ million hectolitres of table wine per annum, which will be sold on the home market "... " During the capitalist period of the industry until 1918, the organisation of wine production took the form of ' a productive, commercial combination '. This is quite comprehensible. Neither

can the State now evolve any other system for the restoration of this industry in view of the technical conditions of this work " (*ibidem*). The free sale of table wine was authorised by the decree of 9 August 1921. This helped to improve the position of viticulture. But private capital could not come to its assistance.

" With a fluctuating exchange it cannot be hoped that private capital can be obtained... The State itself must aid the growers by procuring them material and implements, and by organising the sale of wine "... (*ibidem*, p. 99).

The plan proposes to organise the purchase of grapes and new wine by State organisations and to improve the plants by more productive varieties.

This work should be concentrated on the large estates expropriated by the State, with their cellars, plant and vineyards, which were formerly exemplary.

For the benefit of the State, the Commissariat in 1921 proposed to tax each bottle of wine 25 gold kopeks ($^2/_3$ of a French franc), in order to raise 60 million gold roubles a year from wine excise. The general plan above-mentioned is being carried out as regards the wine-production of the Soviet Union.

By the decree of 26 August 1920, the Commissariat of Agriculture was placed in control of all wine-production, following the initiative of the former Government, extending its programme, : " Government operations in viticulture should take the authorised form of single control ". " The Commissariat of Agriculture should organise a single institution, which would, immediately and resolutely, begin the work of saving and restoring the financial resources, which the viticulture and wine production of the Union can and must assist, on the basis of the realisation of the wine loan by the sale of this product " (SHEFLER, *ibidem*).

It was on this basis, it appears, that a wine-production syndicate was organised in 1921. It unified the greater part of the former large viticultural estates and wine-trading firms. It plays the chief part in the whole of the viticulture of the Union.

In 1923 the Wine Syndicate investigated the spread of phylloxera in Transcaucasia, North Caucasus and Ukraine. It found that the vineyards must be restored everywhere by grafting American stocks. But the lack of this material is evident. Before the war American stocks were imported from abroad, for the Russian nurse-

ries were not yet sufficiently numerous. At present not more than about ten are left, having an area of only 100 ha.

The Wine Syndicate proposes to increase them to 500 ha., to start with, in 1924. To do this it needs 1½ million gold roubles, without which it finds it impossible to restore the vineyards and ensure the development of wine-production (" *Economic Life* ", No. 27, 1 November 1923).

The financial situation of the Soviets will doubtless be the decisive factor in this restoration. In July 1923, at a session of the Commissariat of Agriculture, the Wine Syndicate presented its report of the state of viticulture in the Country (" *Nakanunye* " No. 403, 7 August 1923). The vineyard area is estimated at 137,078 ha. though (this figure may be rather exaggerated). Of this the State owns only 64,469 ha., or 47 %. Some of the Soviet properties do not come under the Wine Syndicate and remain autonomous. Owing to the general measures adopted by the Wine Syndicate for improving viticulture, in 1923 a total yield of 31,661 hl. of wine was expected, i. e. twice that of 1922.

The more favourable weather conditions of the year no doubt played an important part in the basing of this estimate.

Apart from the exploitation of its own vineyards, 4 million kg. of grapes and 20,295 hl. of new wine have been purchased up to the present from the small proprietors, mostly in the regions of Kakhety and Elisabetpol. The wine is sent to the large cellars (formerly those of the Dependencies and private estates) which have up to the present remained empty.

The Wine Syndicate is especially trying to take measures against vine diseases and parasites by supplying the growers with the necessary materials and machinery for treating the vines. It finds that this work can only be successfully developed by the aid of a loan. In 1922-23 the Syndicate advanced to the local winegrowers' unions a sum of 422,934 gold roubles.

These projects of the Wine Syndicate were accepted by the Commissariat of Agriculture as a working scheme, and Russian viticulture and wine-production is at present being organised on this basis. Thus we see that the large Russian viticultural estates and their technical apparatus, are again beginning to be restored and organised on a basis which serves as a model to the whole of Russian viticulture.

If the finances and economic policy of the Soviets permit, this general plan of wine-production work must be considered satisfactory and should gradually restore in Russia, this industry so backward for the moment.

It is evident that this plan, the only possible one under present conditions, is due to the persevering work and technical knowledge of the Russian specialists working in the Soviet territory.

LEON MARKOFF,
Member of the Russian Agricultural Association,
Kingdom of the S. C. S.

VINE-GROWING IN ROUMANIA.

HISTORICAL REVIEW OF VINE-GROWING IN ROUMANIA.

The cultivation of the vine in Roumania goes back to such a remote period that it is not possible to give any exact information as to its origin.

The Romans who came to Dacia found the latter a flourishing state, and gave it the name of " Dacia felix ".

Decebal, King of the Dacians, considered wine a drink of honour and drank it from an aurochs' horn covered with gold. After being conquered by Trajan he broke his sword and then drank a last cup of wine into which he had put poison, in order not to submit to the shame of yielding.

Long before the Christian era the Dacian king Boerebista had ordered the vineyards to be destroyed, without however, according to Strabo, succeeding in getting his order obeyed.

The Scythians, who came to these regions before the Dacians, possessed extensive vineyards and were in the habit of drinking wine pure, unmixed with water ; the observance of this custom, to which he was not used, cost Cleomenes, King of Sparta, his life (1).

Our ancient forests still contain old *vitis silvestris* bushes, clinging like strong creepers to the neighbouring trees and producing tiny grapes with little black seeds, which the peasants call " Laurusca ".

AURELIAN FELIX is right in maintaining that from the earliest times Roumania has been considered the natural home of the grape.

Our wines are of very old renown. As far back as 600 years before the Christian era, an extensive local wine trade was carried on by Greek sailors on the shores of the Black Sea (2).

The Genoese also carried on this trade from the time of their activity in this region. The Romans themselves adopted as an

(1) G. N. NICOLEANO. Introduction à l'Ampelographie roumaine (Introduction to Roumanian Ampelography). Bucarest, 1900, p. 37.

(2) L. PORTES and F. ROUYSSEN. La vigne en Russie (The vine in Russia), (p. 2).

emblem for the city of Tomis (now Constanza) a grape, and this symbol was also struck on the coins and reproduced on terra-cotta ware (1).

The Roman legions, on entering Dacia, introduced new varieties of Italian and Greek vines, technical terms, and special cultural and wine-making methods, which have survived up to the present day with their original Latin names, which are easily distinguishable from the Slav and Dacian terms.

In the course of centuries our viticulture has undergone very serious and sometimes catastrophical crises, but has always recovered without losing any of its fine qualities.

Princes and dignitaries of the country, possessing rich and fine vineyards, have always been found at the head of those whose efforts have been directed towards the reconstruction of the viticultural regions.

Roumanian wines have always been highly appreciated, not only by travellers and visitors from abroad, but also by scientific specialists such as Franz Sulzer (1871), Thomas Thornton (1826), Neugebauer (1854), W. Hamm (1886), etc. (2).

The wine-trade was carried on in ancient times on a large scale with Russia, Poland, Hungary, Austria etc., which countries regularly imported Roumanian wines, and at one time also large quantities of wine for many years were sent to France (3).

It is also to be noted that Cognac brandy made in Roumania, at Ilmeni and Berheci by the firm of Naville and Co., was sent to France, hence it afterwards became known all over the world (4).

The Roumanian wines were comparable to the similar French growths (Chablis, Bordeaux or Champagne) (5). M. Muillefert compares them to the Hungarian or Rhine wines, and others to the Roussillon (6).

In 1711, Peter the Great, Emperor of Russia, much appreciated the Cotnari wines, and recognised their quality (7). Before

(1) Collection in the museum at Constanza and collection of Prof. W. Knechtel.

(2) Quoted by Dr. Ch. D. Drutzo: Etude sur la Viticulture et les vins de Roumanie (account of Roumanian Viticulture and Wines). Bucharest, 1900.

(3) V. C. Munteanu and C. Roman. Les vins de Roumanie (Roumanian wines). Bucharest, 1900, pp. 296-301.

(4) *Pester Lloyd*, Budapest, No 356, of 24 December 189[illegible]. Quoted by V. C. Munteanu and C. Roman.

(5) Etienne Fould, consul at Paris. *Rapport du 15 Novembre* 18[illegible], quoted ibidem.

(6) P. Muillefert. *Les vignobles de France et de l'étranger*. Paris (p. [illegible]).

(7) *Le chroniqueur Neculcea. Chroniques II*, quoted by M. Cogalniceano.

railways were yet heard of, Roumania exported large quantities of grapes, fresh, or dried by a primitive local method (1).

The bouquet of the Cotnari, Magura (Dragashani), Piatra and Nebuna wines, which W. HAMM considers similar to that of the Sahtoni wine, but stronger, was known in the large cities of Western Europe, and was as much appreciated as that of the Tokay, Malaga and Rhine wines, etc. (2).

Our viticulture has suffered great disasters :

a) *The Barbaric invasions*, which lasted more than 100 years.

b) *The attacks of phylloxera* (1884-86) which almost completely destroyed the old vines.

c) *The world war*, which caused enormous loss and injury, both from the occupation by the enemy and the destruction caused by the Russian Bolshevik troops, and from the economic crisis which resulted therefrom.

The losses caused through occupation and destruction are already a thing of the past, and it is believed that the end of the present viticultural crisis has now been reached ; it is hoped that the restoration of the vineyards, which has been delayed for years, will now begin, together with the economic recovery of all the branches of agriculture and industry in our country.

THE WINE-GROWING WEALTH OF ROUMANIA.

The enquiry undertaken by us personally, during which for three consecutive years every wine-growing region of the country has been visited, has led to the following conclusions (3) :

Roumania at present possesses about 250,000 hectares of vines. Bearing in mind, however, that many vineyards are wholly or in part uncultivated and that these gaps have not been made good owing to the war (they form about 10 % of the total area) ; taking into consideration also that others are formed of still young vines, giving no yield, it is estimated that there is a total producing area of about 200,000 hectares.

(1) MARTIAN. *Annales Statistiques pour les années* 1861-1868. Quoted by V. C. MUNTEANU and C. ROMAN.

(2) W. HAMM. Das Weinbuch. Leipzig, 1883, (p. 478).

(3) I. C. TEODORESCU. Organisation de la production et de la vente dans l'industrie viticole. Communication faite au congrès agricole général de Bucarest le 5 fév., 1924 (Organisation of production and sale in the viticultural industry. Report to the General Agricultural Congress at Bucharest, 5 February 1924).

The following statement shows the position of these vineyards:

a) Quality of wine produced.

10,000 ha. (5 %) of vineyards produce *very superior* table wine
110,000 » (55 %) of vineyards produce *good* table wine.
80,000 » (40 %) of vineyards produce *ordinary* table wine.

b) Annual production.

10,000 ha. of vineyards produce an average of 18 hl. per ha per year, total 180,000 hl.
110,000 » of vineyards produce an average of 35 hl. per ha. per year, total 3,850,000 hl.
80,000 » of vineyards produce an average of 42 hl. per ha. per year, total 3,360,000 hl.

Annual average: 200,000 ha. of vineyards produce an average of 31.66 hl. *i. e.*, a total of 7,390,000 hl. of wine.

c) Value of annual yield (based on average prices in 1923).

a)	180,000 hl.	superior wine	at 1400 lei	per hl.	252,000,000 lei
b)	3,850,000 »	table »	» 900	» »	» 3,465,000,000 »
c)	3,360,000 »	ordinary »	» 600	» »	» 2,016,000,000 »
Total . .	7,390,000 hl.	wine	at 966 lei	per hl.	5,733,000,000 lei

(*1 lei = 1 franc at par*)

d) Average cost of production of crop throughout the country.

	Lei
a) *Labour*: 200,000 ha. at 235. 3 days work per ha. 47,060,000 days at 45 lei	2,117,700,000
b) *Material* etc. at 3500 lei per ha.	700,000,000
c) *Rent* at 800 lei per ha.	160,000,000
d) *Plantations and Buildings* at 3500 lei per ha. . .	160,000,000
e) *Direct Excise on wine* at 75 lei per hl.	554,250,000
f) *Expenses of Management* at 2000 lei per ha. . .	400,000,000
g) *Annual Interest on Working Capital* at 2000 lei per ha.	400,000,000
Total annual expenditure . . . Lei	4,491,950,000

e) Annual Net Profit on the Working:

Average value of crop	5,733,000,000
deduct annual cost of production	4,491,950,000
Net Profit . . . Lei	1,241,050,000

or 6,205.25 lei per ha. per year.

Note: The above figures are deduced from the totals of all the calculations. There is a curious phenomenon in Roumania, however: the better class vineyards, producing the finer wines, scarcely yield any profit; they are not a financial success because the cost of production is higher than the value of the crops. This is due to there being no exportation; there are few buyers of choice wines, and so the vines giving large yields are much more remunerative and more sought after, whereas those of superior quality only continue to exist owing to the connoisseurs.

The Vine-growing Areas in Roumania in relation to Growth and Quality of Wines.

Roumania, within its ethnological and natural boundaries, occupies an area of 298,000 sq. kilometres and is situated on the great mass of the Carpathians, which divides the country into two nearly equal parts. On either side of this chain of mountains all the rivers of the country flow down and afterwards unite again and discharge their waters into the Danube and the sea.

All the hills lying below the Carpathians and the higher banks of these water-courses are partly laid out in with vineyards, generally up to a height of 300 metres until they attain their extreme northern limit at 47.6° N. latitude. The Magura Shimlaului vineyards only, situated at 47° N. latitude, are at a height of 550 m. and form a very interesting exception.

The wine-growing character of these regions depends on the climate, the nature of the soil and the varieties cultivated. However, as there is a great variety of soils, the effect of which is only shown in certain special localities, the most important factor which determines the quality of wine, the system of cultivation, the method of pruning and even the number of varieties, is in all cases the climate.

The Roumanian vineyards generally belong to two zones having quite different climates :

1) *The vineyards of the temperate climate* are characterised by the fact that the vines situated on the hill-slopes survive the winter without being earthed over ; the varieties of the third period of ripening (Pulliat classification) may also succeed ; red wines may acquire a rather good colour ; in exceptional years sweet wines may even be obtained ; finally, the form of pruning may be maintained and carried on regularly. In general this climate necessitates a mixed pruning, known under different names, which consists in leaving one or several productive shoots and one or two stocks.

The majority of the Roumanian vineyards belong to this climate ; the most numerous varieties are met with in this zone, among which table grapes succeed best. The period of growth lasts from 200 to 210 days.

The rainfall is more or less regular (500-550 mm. per ann.) ; but the autumn is nearly always calm, dry and rather long, and the white frosts come rather late. The ravages of phylloxera and cryptogamic diseases, especially mildew and oidium, are more severe here than in the following region.

2) *The vineyards of the cold climate*, situated almost on the extreme verge of the zone of cultivation, have the distinctive character that the plants can survive the keen frost during the winter without being earthed over ; there are however exceptional years (1924) in which many shoots perish even when earthed over, especially the yearlings, the stock growing up again from below. This is why the vines in this zone are generally earthed over, and the form of pruning is that of the so-called " Moldavian ", with old shoots, long and trained very high, in " umbrella " form.

In this climate the varieties of the III period of ripening do not succeed or only in exceptional cases and in quite favourable exposed positions. The number of varieties is limited, this being especially due to the cold, rainy autumns and to the early white frosts. The period of growth lasts on an average 180-190 days.

In this northern region scarcely any but white wines are made, light, agreeable, but often very sour. Sometimes the vines are protected against the spring frosts by smoke clouds. The varieties of the I and II period, with a thicker skin, are recommended ; the muscatels have a very pleasant aroma.

Many native vines are still found here, phylloxera being slow to attack this region, contrary in this respect to the others.

Scarcely any disease other than mildew is met with here : oidium is very rare and its attacks are slight in intensity.

Nature of Wine-growing Soils.

The nature of the most renowned wine-growing soils is very varied.

1) The celebrated Cotnari vineyards (Dept. of Iassy) are situated in Upper Sarmatia (Miocene) in Moldavia, on a clay-sandy soil, rich in fine gravel with lime concretions in the proportion of 20- 30 %.

2) The vineyards on the Dniester terraces (Bessarabia) grow on an ancient (Tertiary) cretaceous soil rich in shells, covered with light layers of clay mixed with sand.

3) The Codru district (Bessarabia) which contains the best vines under the northern climate, has a forest soil with a thick layer of chernozem, very rich in humus.

4) The famous Cetatea Alba vineyards (Bessarabia), like those of the Mihai Valley in the Theiss plain (Transylvania) grow in hot sands, ancient dunes, producing fine and delicate wines which recall certain years of the Sauterne wines.

5) The well-known Dragashani vineyards (Oltenia) where the best wines, almost sparkling, are obtained, grow on slightly ferruginous yellow sand, containing a large proportion of small gravel and some lime nodules.

6) At Minish (Dept. of Arad) in Transylvania, the famous liqueur wine known as " Minis " (1) is obtained with the local variety " Cadarca neagra ", in vineyards planted on the diorite rock terraces on the spurs of the western Carpathians.

7) The Alba Julia and neighbouring wines which have the most marked bouquet, are produced from the " Feteasca " variety, planted in a soil formed of marly schists (bed rock exposed).

Some well-known Roumanian vineyards.

It is very difficult to classify the Roumanian vineyards according to the wine types produced in the different districts.

(1) Wine prepared like Madeira, Sherry, etc. (Ausbruch).

The most important localities, per province, are therefore given :

1) *Bessarabia*

The best vineyards extend along the Dniester terraces, their only speciality is red table wines, among which the *Shaba*, *Cetatea Alba*, *Purcari*, *Tighina*, *Speia* and *Saharna* hold the first place.

Towards the North-West, in the interior of the province, are the " Codru " vineyards, which produce choice wines at *Taleshovo*, *Romaneshto*, *Cazaneshti* and *Vascautzi* ; the vineyards at *Calarashi*, *Strasheni*, *Tzeleneshti* and *Bucovitz* are cited as vineyards of extensive production.

In the centre of Bessarabia the best wines are produced at *Kishinau*, *Leontievo*, *Vadullui Voda*, *Miciuca*, *Bolboca*, *Pojèreni*, *Tighina*, *Caushani*, *Comrat*, *Costeshti*, *Cojushna*, *Nisporeni*, etc.

South Bessarabia produces some very fine wines ; besides the vineyards already mentioned at *Shaba* and *Cetatea Alba* on the banks of the Dniester, the centres of production in this region are *Tziganca*, *Bolgrad*, *Borceag*, *Baimaclia*, *Tatareshti* and *Noul Caragaci*.

2) *Moldavia*

The most noted vineyards in the North of this province are those at *Cotnari*, near Harlau, and those in the neighbourhood of *Iassy* (*Copoul*, *Vishanul*, *Doi Peri*, *Bucium*, *Uricani*, etc.).

In Central Moldavia are the fine " Codru Tigheciu " vineyards, at Hushi, together with the Vutcani, Cotzoiu, Pleshu, Turbatu, etc. regions.

But the most celebrated vineyards in the country, renowned for their extensive production, good quality and the important trade carried on in the district, are in South Moldavia.

The great vineyard centre of Odobeshti, with branches at Patzeshti, Zarishtea and Varsatura, is placed in the first rank ; then comes Panciu and its neighbourhood : Tzifeshti, Clipiceshti, Stracane and Pauneshti, and finally Marasheshti with Padureni, Pufeshti, etc.

The second place is held by the Nicoreshti vineyards near Tecuci, with the Piscul Corbului, Coasta Lupei and Sârbii regions, which are noted for the wines formerly produced there, and have ramifications extending along the Sireth valleys as far as Galatzi, near which are certain of the most highly prized vineyards.

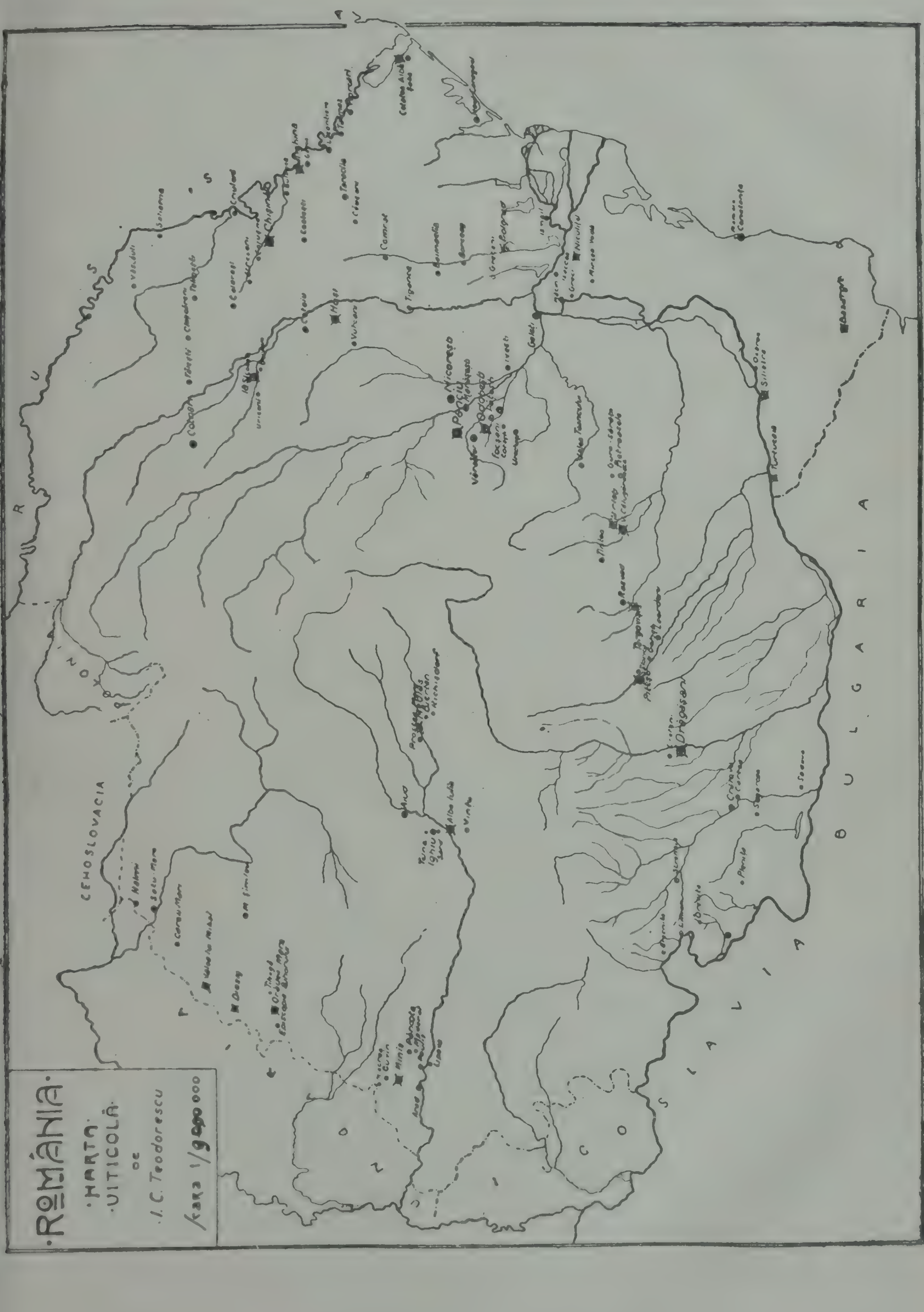


FIG. 29. — Vine-growing map of Roumania, showing only the central regions.

3) *Muntenia*

The vineyards extend along the hills below the Carpathians, commencing with Odobeshti and continuing as far as the River Olt, which separates this province from Oltenia.

The most renowned centres in this long strip of vineyards are *Dealul Mare*, with the *Bucov*, Scaeni and Tzintea districts on one side and the Valea Calugareasca, Urlatzi and Ceptura on the other; these are the best known vineyards in Muntenia.

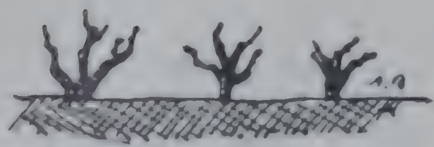


FIG. 30. — Short pruning adopted in the sandy regions of Cetatea Alba (Bessarabia) and Valealui Michai (Transylvania).

Next come the Busau vineyards with the Sadul Sapat, Pietroasele, Gura Saratzii and Valea Teancului districts; continuing in this direction the very fine vines of Rãmnic-Sarat, Urecheshti, Coteshti, Faraoane and Varteshcoiu are reached.

In the second rank come the vineyard district of Targovishte with the Razvadul and Gura Ocnitzei districts and the Muscel district with the Piteshti hills, in which the most important places are: Goleshtii, Loerdinii, Florida and Titeshti.

4) *Oltenia*

The vineyards of this little province are no longer so numerous as formerly, but they have a very special reputation.

The celebrated Dragashani vines are found here, as also those of the *Maciuca*, *Calnia*, *Cretzeni*, *Orbeshti*, etc., districts. There are also the *Golul Drincei* and *Orevitza* vines.

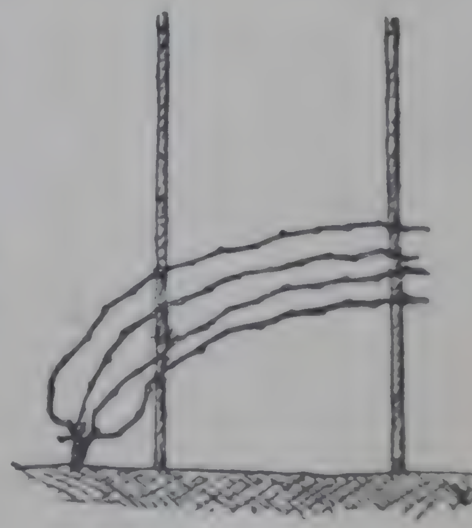


FIG. 31. — Pruning adopted at Sarica (Dobruja)

Next comes the area in the neighbourhood of *Craiova*, with what are known as the *Vulcaneshti* vineyards, which extend towards Circea and Ghercesehti. The vines of the *Segarcea* Crown lands in the *Dealul* district, *Bobului* and *Sadova*, *Plenitza* etc. are also well known. In the neighbourhood of *Turnu Severin* other fair quality vine-

yards are to be seen at Bresnitza, Simian, Glogova, Hinova, Strebaia, etc.

5) *Dobruja*

The vineyards are grouped according to centres, of which the best known is that of *Sarica*, Dept. of Toulcea, with branches at *Badila, Niculitzel, Isaccea, Cocosh, Măcin* etc.

The vineyards in the neighbourhood of *Constanza, Silistria, Turtucaia, Caliacra* and *Balcic* are also important.

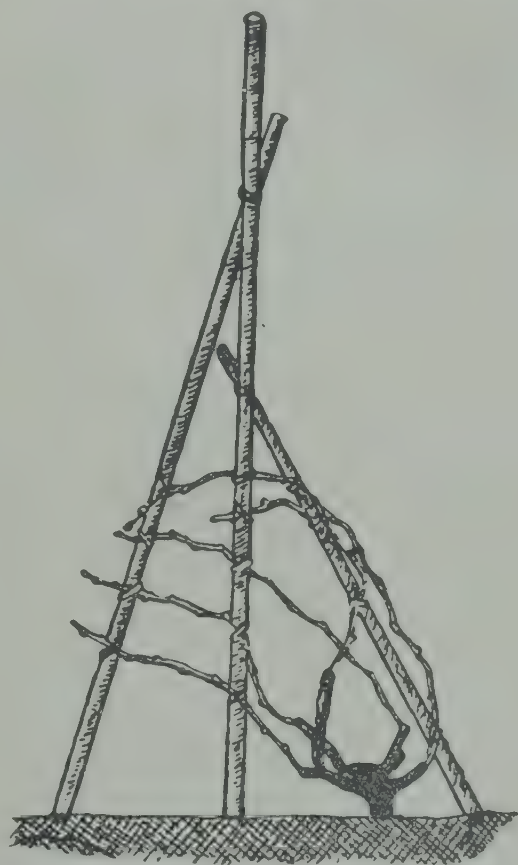
6) *Transylvania*

The reputation of the vineyards of Transylvania is high outside Roumania.

The most important centres in this province are:

a) The *Alba Julia vineyards*, noted for the bouquet of their wines, the following being the most important districts: *Ighiu, Tzelna, Ighiel, Bucerdea, Shard, Cricau, Cimbrut* and *Aiud*.

b) The Tarnavele vineyards, with an equal reputation for the fineness of their wines, are principally in the following localities: *Mediash, Prostea, Mare, Bogaci, Basna, Bichisdorf, Sheica, Mica, Biertan*, etc.



Fig, 32. — Pruning adopted at Pietroasa (Buzan, Muntenia).

c) *The Arad vineyards.* These vineyards are of enchanting beauty. They extend for a distance of more than 40 km. and the most esteemed wines are produced at *Minis, Paulis, Mocrea, Magherat, Pancota*, and then at *Shiria, Baratzea, Cuvin, Ghioroc*, etc.

d) The Bihor vineyards (Eriul district) include the *Oradea Mare* vines, with ramifications towards *Episcopia Bihorului* at Alejd; from Teleaga towards the heights of *Bezul*; from *Voideni* to *Ianca*,

Diosig, *Secueni*, towards the *Mihai Valley* and *Shimian*, whence they take the direction of *Careii Mari*.

The best wines of the district are obtained at *Marghita*, *Abramutz* and *Lecimer*, and also at *Magura Salagiului Tashuad*.

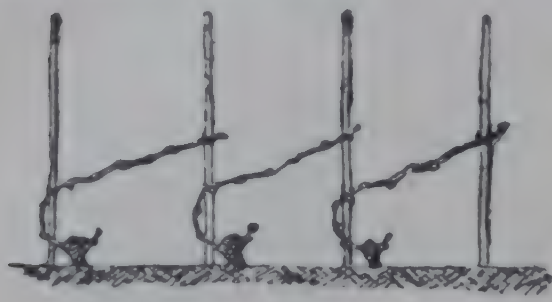


FIG. 33. — Pruning adopted at Dragashani (Oltenia).

e) *The Satul Mare and Halmei vineyards*. The last region of North Transylvania possesses fine vineyards at *Careii Mari*, *Satul Mare*. *Tashnad*, *Sanisläu* and at *Seini*, *Teutzi* and *Baia Mare* the wines appear to be the best of the district.

f) *The Banat vineyards*. Though almost in open country, the Banat, thanks to good methods of cultivation produces fair quality wines, especially at *Aradul Nou*, *San Nicolaul Mare*, *Teremia Mare* and *San Petru Mare*.

METHODS OF CULTIVATION.

In general, three kinds of pruning and cultivation are adopted in Roumania :

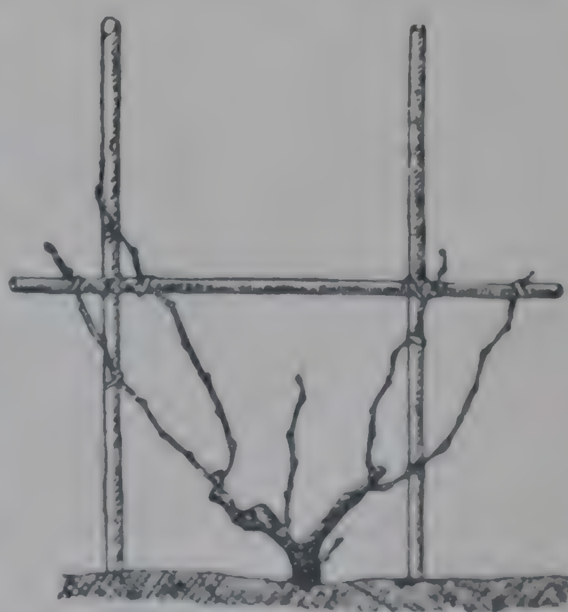


FIG. 34. — Pruning applied to the direct producer hybrids in Bessarabia.

a) *Pruning close to the stocks* is adopted in the vineyards at Erful, Bihor, Satul Mare and Valea lui Mihai in Transylvania, at Cetatea Alba in Bessarabia and as yet only to a small extent in the Dept. of Constanza (Dobruja) and the Depts. of Dolj and Mahedintz in Oltenia (Fig. 30).

Generally from 6000 to 8000 plants are set per hectare and the young shoots are tied to a single pole.

b) *Mixed pruning*, similar to Dr. Guyot's, but modified by leaving from 2

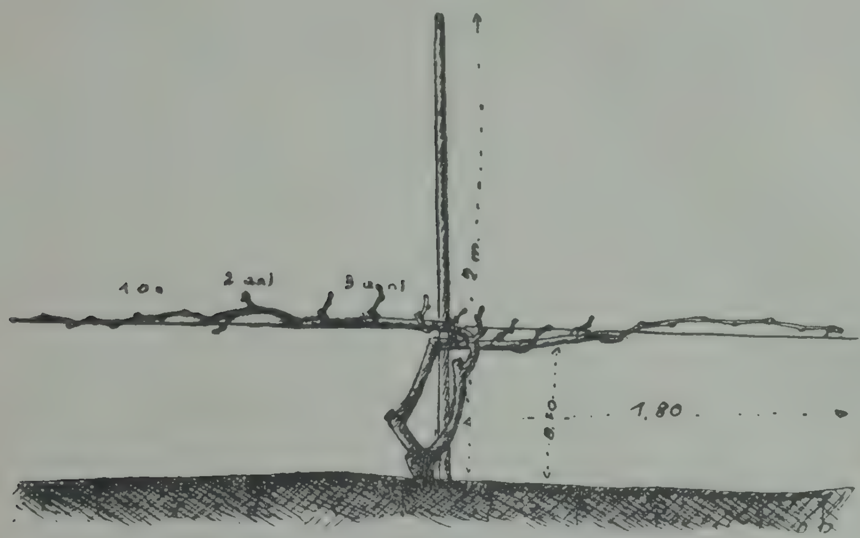


FIG. 35. — Vine trained on wires in Roumania.

to 4 and even 12 shoots on each plant. The pruning and tying-up methods are different, but in all of them the vine is trained on espaliers or props. Generally from 3,500 to 6,000 plants are set per hectare (Figs. 31-40).

c) "Umbrella" or "Moldavian" pruning is a quite special local method employed in Moldavia and Bessarabia on rich soil exposed to late cold and white frosts. It consists in leaving 4 or 5 of the larger and older canes on which 8 to 12 or as many as 14 long fruit bearing spurs are also left, with from 8 to 12 shoots. Only the stronger varieties can endure this form of pruning. From 8 to 16 hundred vines are planted per hectare, each supported by 10-20 light poles (Figs. 41-45).

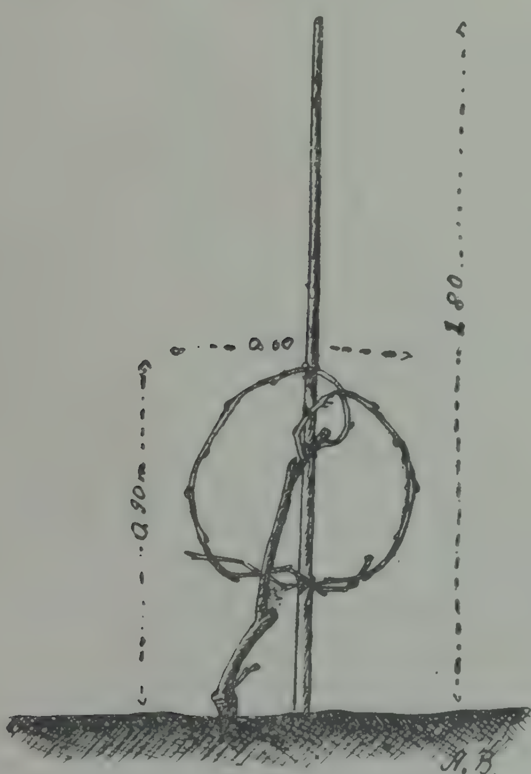


FIG. 36. — Ring pruning in Transylvania.

Some typical varieties of Roumanian vines.

1) The renowned red wines of *Orevitra* and *Golul Drincei* (Dept. of Mehidintz) which were formerly much sought after abroad, were prepared from the following varieties :

1/3 Negru Vertos
1/3 Negru moale
1/3 Berbecel

2) The fine *Dragashani* wines are made from :

1/3 Crâmposia
1/3 Braghinâ
1/4 Gordan Tämâfoasa Alba (muscat).

3) The *Odobeshti* wines :

2/3 Galbenä
1/3 Plävae.

4) The *Cotnari* wines :

1/3 Grasa
1/3 Feteasca
1/3 Fräncusa Busuicaca (muscat).

5) The *Alba Julia* wines :

1/2 Feteasca
1/4 Grasa
1/4 Furmint

6) The *Minish* wines :

red : 2/3 Cadarca neagra
1/3 Pinot Cabarnet ;
white : Eustoasa
Alb marunt
Bakator.

7) The *Eriul* (Bihor) wines :

Ardeleanca
Coada Oii
Bakator.

8) The *Bessarabian* wines :

white : Pläavaia
Galbenä
red : Bara neagrä
Negru de Cäusani

Table showing the most important Roumanian varieties, their ripening period and the province in which they are most cultivated (1).

A) *Varieties of Table Grapes.*

1) Alb mare	II (Moldavia)
2) Bäsicatä	II (Muntenia)
3) *Ciaius*	III (Dobruja)
4) Coarna Albä	II (Oltenia and Muntenia)
5) Coarna Neagra	III (Muntenia)
6) Ochii boului	II (Bessarabia)
7) Coama boereasca	II (Moldavia)
8) Poama Mare	II (Moldavia)
9) Bazachia rosie	II (Muntenia)
10) Slavitza	I (Oltenia)
11) Tamaicasa alba	II (throughout the country)
12) Tamaicasa rosie	II (Muntenia)
13) Tâta caprii	II-III (Muntenia & Dobruja)
14) Tâta vacii	III (Oltenia)

B) *Varieties of White Wine Grapes.*

1) Albissori	II (Transylvania)
2) Armas	I-II (Moldavia)
3) *Ardeleana*	II (Transylvania)
4) Batutä albä	II (Bessarabia)
5) Berbecelul	I-II (Oltenia)
6) Brumaria	II (Bessarabia)
7) Cabasma	II (Bessarabia)
8) Cioinica	II (Moldavia & Bessarabia)
9) Coada-oii	II (Transylvania)
10) *Crâmposia*	II-III (Oltenia)
11) Creata	II (Transylvania)
12) Crucoilita	II (Moldavia)
13) *Feteasca*	II (Moldavia & Transylv.)
14) Frâncusa	II-III (Moldavia & Transylv.)
15) Galbena	II (Moldavia & Transylv.)
16) Grasa	I-II (Moldavia & Transylv.)
17) *Gordanul*	II (Oltenia)
18) Gordinul	II (Muntenia)
19) Iordan	II-III (Moldavia) Transylv.)
20) Mischet	II (Dobruja)
21) *Mustoasa*	II-III (Moldavia & Transylv)
22) Omoräu	II (Moldavia)
23) Ovis	II (Muntenia)
24) *Plävaia*	II-III (Moldavia & Bessarabia)
25) *Samoveanca*	II (Dobruja)
26) Seina Albä	II (Muntenia)
27) *Silvan verde*	II-III (Transylvania)
28) Struguri Craesti	II (Transylvania)
29) *Tämâioasa*	II (everywhere)
30) Verdea	II (Moldavia)
31) Zghihara	II-III (Bessarabia)

C) *Varieties of Red Wine Grapes.*

1) *Braghina*	II (Oltenia)
2) Romania	II (Oltenia)
3) Bosioara	II (Oltenia)
4) Vulpea	II-III (everywhere)

D) *Varieties of Black Wine Grapes*

1) *Babeasca neagra*	II-III (Transylvania)
2) *Cadarca*	II-III (Moldavia)
3) Negru bulgar	II (Bessarabia)
4) *Negru de Cäusani*	II (Moldavia & Bessarabia)
5) *Negru Vertos*	II-III (Oltenia)
6) Päsäreasca	II (Moldavia)
7) Poama Calului	II (Oltenia)
8) *Negru moale*	I-II (Oltenia & Moldavia)

(1) The most important varieties are printed in *italics*.

VIII. — Principal Foreign Varieties cultivated in Roumania.

1) Alicante Bouchet	(Muntenia and Oltenia)
2) Aligoté	(Bessarabia)
3) Aramon	(Oltenia)
4) Cabernet Sauvignon	(all over the country)
5) Chardonnay	(Bessarabia)
6) Chasselas	(all over the country)
7) Clairette	(Oltenia and Muntenia)
8) Consaut	(Muntenia and Bessarabia)
9) Colombard	(Muntenia)
10) Durif	(Bessarabia)
11) Furmint	(Transylvania)
12) Gamay	(Bessarabia)
13) Grand Noir de la Calmette	(Muntenia)
14) Honigler	(Transylvania and Moldavia)
15) Malbec	(Bessarabia)
16) Merlot	(Bessarabia)
17) Meslier	(Bessarabia)
18) Mondeuse	(Bessarabia)
19) Muscadelle	(Bessarabia and Muntenia)
20) Muscat Frontignan	(Oltenia and Moldavia)
21) Muscat Ottonel	(Moldavia and Transylvania)
22) Petit Buchet	(Oltenia and Muntenia)
23) Pinot	(all over the country)
24) Portugais bleu	(Transylvania and Bessarabia)
25) Rhein Riesling	(all over the country)
26) Sauvignon	(Muntenia and Bessarabia)
27) Sélection Carrière	(Moldavia)
28) Semillon	(Moldavia and Bessarabia)
29) Traminex	(Transylvania and Bessarabia)
30) Welch Riesling	(Transylvania)

Direct Producer Hybrids introduced into Roumania.

1) Alicante × Rupestris Terras No. 20 (Muntenia, Oltenia and Moldavia)
2) Delaware red (Transylvania)
3) Chasselas pink × Rupestris 4401 Couderc (Bessarabia)

4) Seibel Nos. 1, 14, 156, 848, etc. (Bessarabia, Moldavia)
5) Noah (Transylvania)
6) Gaillars Girars No. 157 (Moldavia)

Grafting Stock used in Roumanian Vine-growing.

65 % Riparia gloire de Montpellier (Portalis)
20 % Riparia × Rupestris 3306, 3309 and 101-14
10 % Berlandieri × Riparia 420-A and Teleky
5 % Aramon × Rup Ganz No. 1, Mourvèdre × Rup 1202, Rupestris du Lot, etc. . . .

INSTRUCTION IN VINE-GROWING.

1. The National School of Vine-growing at Kishinau, organised after the model of the middle schools at Montpellier, Geisenheim, Conegliano and Kosterneuberg, is provided with every modern appliance, such as laboratories, a museum, fields for collections of specimen vines as well as an experimental station of vine-growing and wine-making, with sections for vine-growing, chemistry of wine-making, microbiology, agreogeology and a subsection for meteorology. The courses last four years; pupils holding the diploma for the four secondary classes of a *lycée* are admitted.

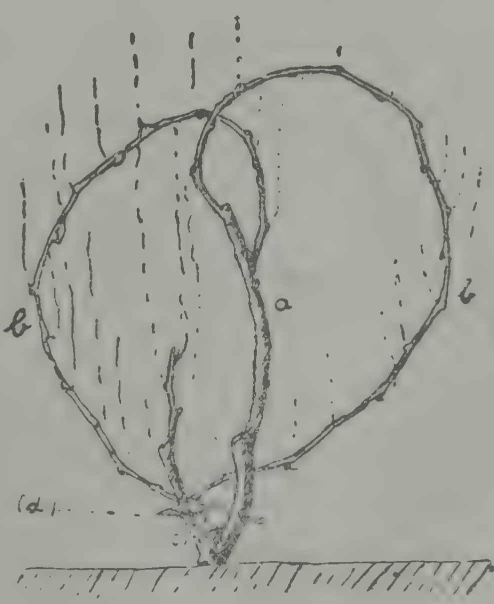


FIG. 37. — Pruning in Transylvania.

Connected with this School there is also a well-equipped bio-entomological station.

2. There are *Practical Schools of Vine-growing* at: *Scharna* (Bessarabia), *Hushi* and *Odobeshti* (Moldavia). *Valea Calugareasca* (Muntenia), *Minish* and *Diosig* (Transylvania) Their object is the training of good practical workers capable of managing vineyards, cellars, or vine nurseries, etc.

The practical school courses last 4 years and pupils holding the elementary school certificate are admitted. All the vine-growing schools have accomodation for boarders; 75 % of the boarders hold Government scholarships and 25 % are paying scholars

3. In addition to these special schools, all the higher schools of agriculture have a lectureship in vine-growing and oenology and

FIG. 38. — Special form of pruning adopted for the Cadarca variety at Minish (Transylvania).

FIG. 39. — Pruning in Transylvania.

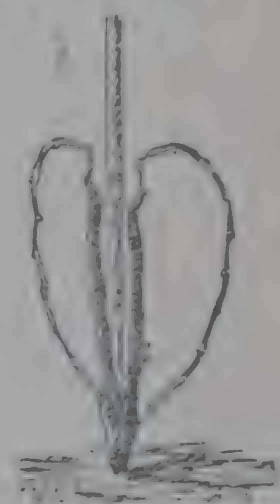


FIG. 40 — Pruning in Transylvania.

instruction in vinegrowing and wine-making is given in all the intermediate schools of agriculture

STATE VINE-GROWING INSTITUTIONS

A) *Vine nurseries*:

a) Bessarabia

1) *Bucovătz*

2) *Ismail*

3) *Botnareshti*

4) Noul Caragaci

5) Comrat

6) Dealul Codrului.

b) *Moldavia*:

1) *Cotnari*

2) *Vishan*

3) Nicoreshti
4) *Petreshti*
5) Bärlad.

c) *Muntenia* :
1) *Istritza*
2) *Goleshtii Batii*
3) Draganeshti

d) *Oltenia* :
1) *Strehaia*
2) *Dragashani*
3) Magheresti.

e) *Dobruja*
1) Murfatlar.

f) Transylvania :
1) *Ceala*
2) *Baratzca*
3) Recash
4) Tashnad
5) *Ighiu*

B) *Vine-growing Stations* :
1) Kishinau (experimental station)
2) Baltzi
3) Cetatea Alba.

C) *Experimental ad Demonstration Vineyards* :
1) Kishinau
2) Costiugeni
3) Pietroasa.

D) *Large Government Cellars* :
1) *Minish* (20,000 hl.)
2) *Diosig* (15,000 hl.)
3) Cluj
4) Dicio San Martin.

E) *Laboratories for Wine Analysis* (1) :
4 at Bucharest
2 » Iassi
1 » Cluj
1 » Kishinau

(1) In connection with the application of the law against fraud in vine-growing and the wine trade.

1 at Arad
1 » Craiova
1 » Statul Mare
1 » Constantza
1 » Galatz

This list of laboratories does not include the Agronomical Station at Bucharest, which possesses a special section for wine chemistry.

Private Organisations.

a) There are more than 40 vine-growing nurseries in the country, the most important being:

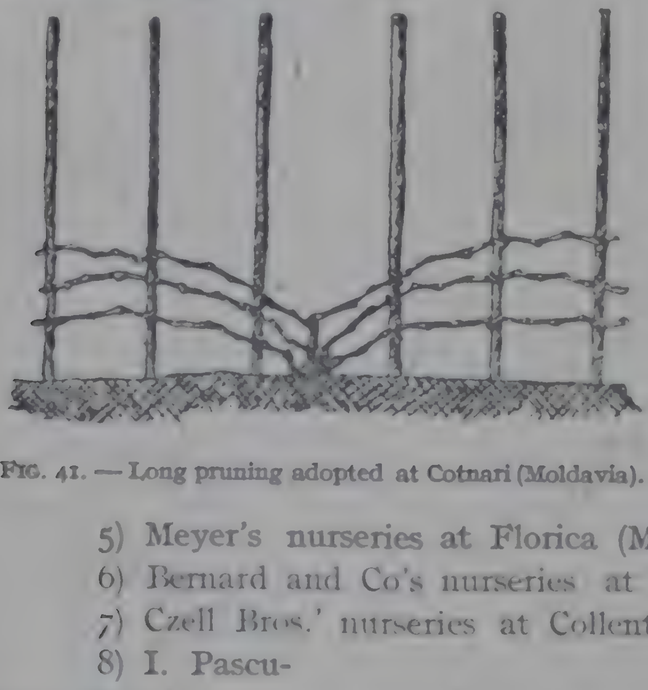


Fig. 41. — Long pruning adopted at Cotnari (Moldavia).

1) Ambrosi's nurseries at Aiud and Mediash (Transyl.);

2) Gaspari's nurseries at Mediash (Transyl.);

3) Prince Stirbey's nurseries at Buftea (Muntenia);

4) Prince Brancovean's nurseries at Brancoveni (Oltenia);

5) Meyer's nurseries at Florica (Muntenia);

6) Bernard and Co's nurseries at Tecuci (Moldavia);

7) Czell Bros.' nurseries at Collentina (Mun.);

8) I. Pasculescu-Buftea's nurseries at Cràvedia (Mintenia);

9) Cèl. Solacolu's nurseries at Bucarest (Montenia);

10) Scgrager Bros.' nurseries at Kitila (Muntenia);

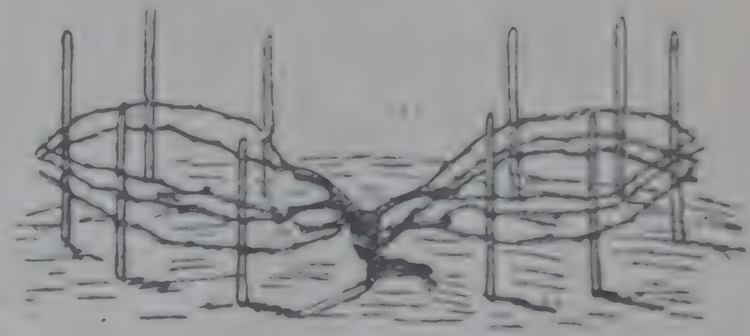


Fig. 42. — "Moldavia" pruning at Odobesti (Moldavia).

11) Marcoci's nurseries at Tassy (Moldavia);

12) Silberman's nurseries at Kishindu (Bess.).

b) Vine-growing Societies.

There are in all 31 Departmental vine-growing Societies (1), with 27 000 grower members, representing 72 428 hectares of vines. All these syndicates are united in a " Vine-growing Societies Union "

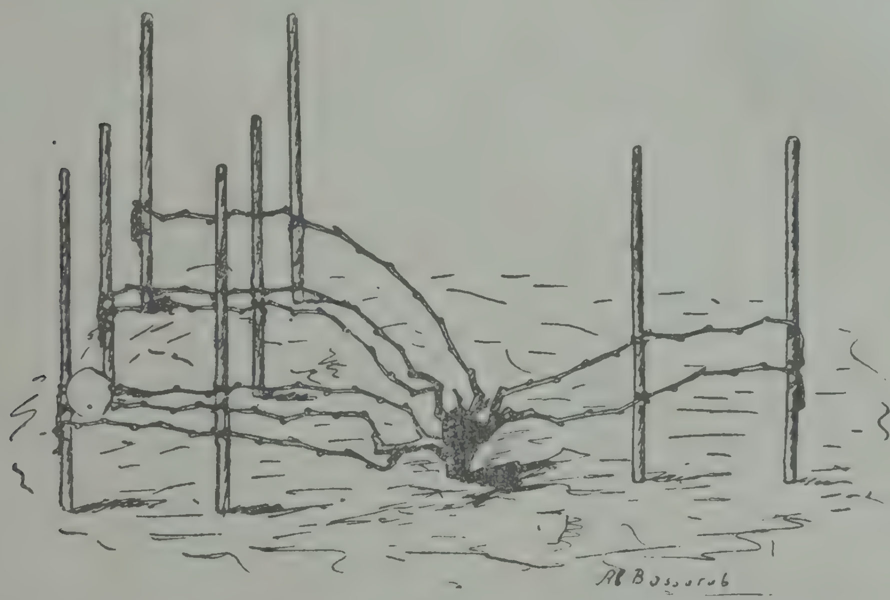


FIG. 43. — Special system adopted by the vine growers at Husi (Moldavia).

FIG. 44. — Classic " Moldavia " pruning.

with its headquarters at Bucarest. Unfortunately the Vine-growers' Union is only concerned with the joint purchase of materials and

(1) In Muntenia there are 12 vine-growing Societies, in Moldavia 7, in Oltenia 4, in Bessarabia 3, in Transylvania 2 and in Dobruja 3.

the protection of general interests, and not with the realisation of production. A large vine-growers' bank and numerous other smaller banks provide the necessary capital for vine-growing.

There are numerous wine depôts in the country. The trade is carried on by foreign merchants, who assist materially in placing the wines on the home market, and are in a position to take up exportation.

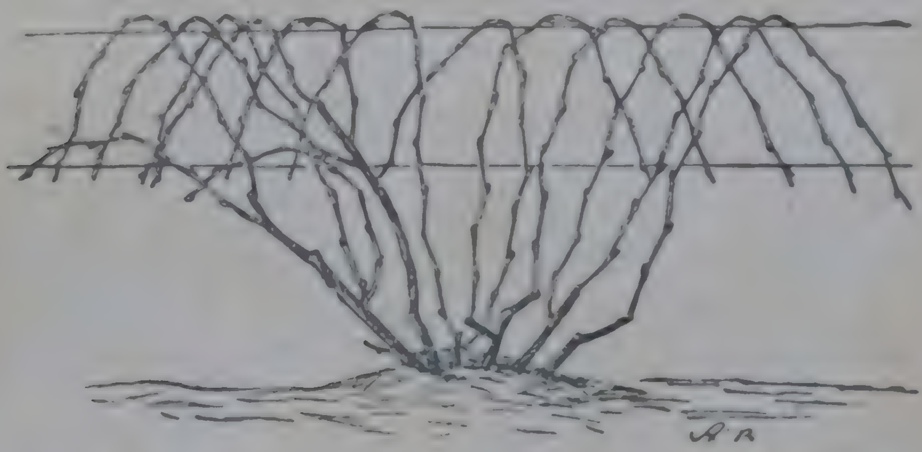


FIG. 45. — Very long pruning adopted in the most productive vineyards of Moldavia.
Vines trained on wires.

There are numerous wine-producing firms in the country which sell their wines direct, as well as firms which produce sparkling wines of the Champagne type.

In Rumania as a rule new wine, that is wine in the first year of production, is used. Only certain large proprietors and connoisseurs allow their wines to mature.

The collection of wines at the National School of Viticulture at Kishinău is celebrated; it includes over 20 000 bottles, classed in series and varieties, from 1894 up to the present time.

I. C. TEODORESCU,

Inspector of Viticultural Instruction and Lecturer on Viticulture, at the Higher School of Agriculture, Herăstrau (Bucharest).

PLATE XIV.

FIG. 46. — "Rara Meagra" stock trained in the "Moldavia" form (Photograph from the Experimental Vine-growing Station at Chisinau).

PLATE XV

Fig. [illegible] — "Chasselas blanc" stock trained in the "Moldavia,"
from Photograph from the Experimental Vine-growing Station at [illegible].

FIG. 48. — Method of earthing stocks trained in the "Moldavia" form in Roumania. The stocks covered.

PLATE XVII.

FIG. [illegible] — State cellar at Minis (Transylvania). Capacity [illegible] hl.

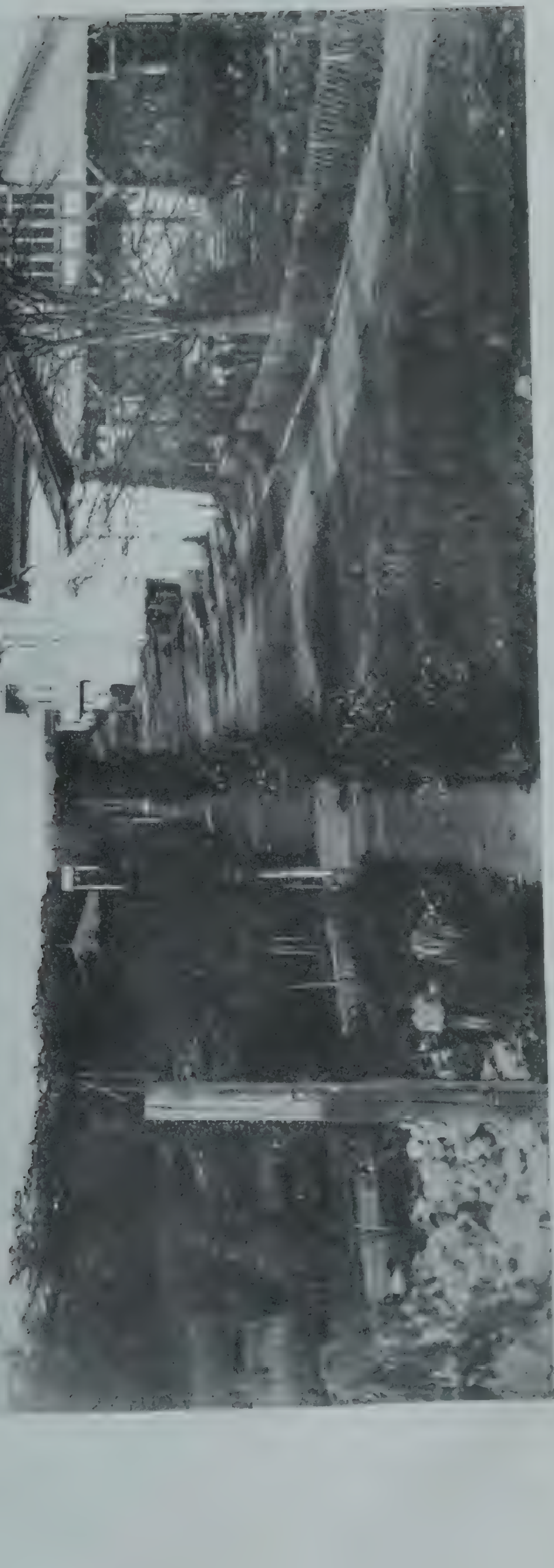


FIG. 50. — National Vine-growing School at Chisinau (Roumania).

PLATE XIX.

Fig. [illegible].—General View of the Practical Vine growing School at Husi (Moldavia)

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NUTRITIVE VALUE OF PHOSPHORUS IN CATTLE FEEDS.

The mineral elements most necessary to the animal organism are phosphoric acid, lime, chlorine, potassium, soda, magnesia and iron. The proportion of these elements varies according to the nature of foods, and in the case of plants, according to the state of the soil, its composition, the nature of the fertilisers used and the quantity of water it contains.

Recent works have drawn attention especially to the importance of lime in the functioning of the different elements in the animal organism. The important part it plays in the origin of certain processes of rachitis, apart from poorness in vitamines, is well known. Further, recourse to carbonate of lime is advised when the quantity of phosphorus is sufficient. The carbonate of lime is partially dissolved through the aleatory carbonates of the intestinal fluids which transform it into bicarbonate. In this form it enters the blood and the bone cells transform it into bone phosphate of lime through the aid of alkaline phosphates.

If there is also a deficiency in phosphorus, phosphate of lime must be used ; but it is generally admitted, at least in Europe, that this is rather exceptional.

During our stay at the veterinary laboratory at Pretoria in May, 1923, we became fully acquainted with its research work tending to prove that deficiency in phosphorus is an important factor in the etiology of a disease known in South Africa under the name of *lamziekte*.

The discoveries in this connection made by Doctor THEILER, Director of the Research Laboratory, and his collaborators, Dr. GREEN and DR DU TOIT, led these scientists to extend the field of their researches to the part played by phosphorus in food, thus envisaging more closely the economic point of view. This side of the question is not without interest for Belgium, and similarly we should likewise realise the possibility of the existence of *lamziekte* in our own colony. This has induced us to publish the notes taken on the spot, which can be completed by a report from the authors quoted. We shall not

however deviate from the principal and more important aspects of the problem, omitting purely technical details.

Lamziekte is a disease which has been known in South Africa for about fifty years and has spread considerably in Bechuanaland. It is not a contagious disease, as was at first believed, though the unburied bodies of animals which have succumbed to the disease may be the cause of its dissemination in localities hitherto immune. The reason of this is as follows : investigations have proved that, to contract the disease, animals must be attacked by the form of pica known as *osteophagy* and also consume the carcasses of animals containing a ptomaine produced by a bacillus allied to the *Bacillus botulinus*. This bacillus is a saprophyte of certain soils.

The disease has been reproduced experimentally in the horse, sheep, goat, ostrich, duck and guinea pig. But under natural conditions these are but rarely attacked owing to the fact that osteophagy rarely develops among them.

The spread of the disease is dependent on the season. Heat and drought at the beginning of summer are favourable to the multiplication of the organism, when the carcases are in a state of decomposition.

The extension of the disease depends on four chief causes : flies, dust, birds and transport by animals over long distances. The flies only serve as an instrument for mechanically conveying the infection from one carcass to another. Birds and dogs, transporting the remains of bodies, propagate the disease at a distance.

The results of experiments made show that the bacterium causes the disease only when generated in organic matter.

Pica. — The depraved appetite of livestock is not confined to South Africa, but over extensive tracts of this country a large percentage of the animals show a preference for bones, whence the name osteophagy. Further, this osteophagy exists in varying degrees. Thus, the animals may eat the bones if they come upon them by chance, or they seek them, or again certain individual animals select bones in a slight state of corruption, whereas others attack those in an advanced state of putrefaction. The cause of osteophagy is certainly a lack of phosphorus in the food, as we shall see later. It is more marked when the pasture on which the animal lives contains the smallest quantity of phosphates, and less accentuated after the rains at the beginning of summer when the new grass is richer in phosphates.

Similarly, osteophagy disappears after the administration of phosphorus in any form whatever.

It does not follow that *lamziekte* must necessarily prevail from the fact that osteophagy is very common in a district. The bacterium indeed must be present and protein substances lend themselves to its development and the production of toxins. Also the bacterium and protein substances may be present and *lamziekte* remain unknown if the soil is sufficiently rich in phosphorus and if the animals are not thus predisposed to osteophagy. Nevertheless, the latter always renders possible the appearance of the disease.

Symptoms. — Generally speaking, it appears without warning. At most, signs of general weakness become evident for a day or two. A very acute, an acute, and a moderate form may be distinguished.

Highly acute form. — Death ensues very quickly, or the animals are found dead without having shown any marked symptoms. It was formerly mistaken for anthrax. This is the rarest form.

Acute form. — The most common. The animal is dull and neglects its food. Then ensue muscular weakness, the stiffening of the hind quarters and a tendency to fall; decubitosis becomes permanent and paralysis sets in. Temperature normal. Constipation. Sometimes paralysis of the pharynx and tongue and hypersalivation. The sickness lasts for some days and death usually ensues.

Moderate form. — Less frequent. The stiffening of the hind quarters and progressive muscular weakness are noticed. The appetite is more or less normal. Decubitosis is more frequent, and after a fortnight the symptoms become more pronounced and death may ensue. Cures have, however, been effected.

Lesions. — Nothing specific. Various congestions and spots.

Prophylaxis — Treatment. — In order that adequate measures may be adopted the etiology should be borne in mind. It may be summarised under six heads:

1. The toxin which poisons the animal;
2. The saprophytic bacillus producing the toxin;
3. The dead body in which the toxin is produced;
4. Pica, or perverted appetite, which urges the animal to eat decomposed matter;
5. The vegetation producing pica, the soil on which it grows and the climate;
6. Predisposition of the animals to contract this pica and their receptive capacity for toxin.

Theoretically, it would be easy to dispense with No. 3 by removing the carcasses from the fields, which would be followed by the disappearance of *lamziekte*. But this is not a practical solution of the problem, owing to the difficulty of finding the bodies, at least those of small animals. The simplest procedure is to supply the livestock with bone meal. It should be noted that the toxin being destroyed by heat, the bones of carcasses may be used for this purpose after boiling. If the animals are numerous, those presenting symptons of osteophagy should be sought out and fed from troughs containing bones which have been subjected to the action of heat, and they should be removed from the herd and given bone meal.

An attempt may now be made to draw conclusions from the tests made, in order to determine the action of phosphorus on various functions of the organism.

A) *Influence of phosphorus on weight, general health and growth.* — As we have already stated, osteophagy is a proof of the lack of phosphorus in food. If this element be added, the gain in weight is extraordinary, as shown by tests made on two lots of animals on pasture of which one had received a supplement of bone meal. The phenomenon is more marked with younger animals, seeing that growth as well as fattening is influenced by the phosphorus factor.

B) *Is the quantity of phosphorus required to prevent osteophagy equal to that which is most favourable to growth?* — Though osteophagy is an excellent index of deficiency in phosphorus, it does not show the exact quantity of phosphorus required in feeds. A certain number of animals, especially of young animals, on the other hand, show no traces of osteophagy, while their need of phosphorus may easily be proved. Further, osteophagy often appears when the extent of the deficieney in phosphorus is clearly below the highest needs, from a nutritive point of view. Thus, all other conditions being similar, the increase in weight was 166 lb. for a calf under treatment; 295 lb. for one receiving just enough phosphorus to prevent osteophagy, or in all 15 lb. of bone meal, and 352 lb. for one receiving an excess of bone meal, or a total of 75 lb. It is clear that the quantity of bone meal required to prevent osteophagy has a great influence on growth, but is not the optimum quantity. Tests which are being made will determine the latter, as well as the "most economic" quantity, in connection with growth, fattening, gestation and milk secretion.

C) *Influence on milk yield.* — The absence of phosphorus is a factor which limits milk production. The data will be published later.

D) *Weight and strength of the calf at birth.* — Calves born of cows receiving phosphorus are heavier and stronger.

E) *Precocity.* — Animals lacking phosphorus are less advanced.

F) *Quality of meat.* — The muscular system is more developed under the influence of phosphorus, the meat more tender, and has a higher percentage of butcher's meat. This is an important point in exportation.

G) *Influence of phosphorus on consumption of food.* — Livestock receiving phosphorus consume more hay and utilise it better, i. e., the unit of food consumed produces a higher increase in weight.

Lack of phosphorus in plants. — A complete analysis of grass at different times of the year enables the following conclusions to be drawn (tests carried out on the Armoedsvlakte farm at Vryburg):

Young grass at the beginning of spring (October-November) is very nutritious and rich in phosphorus, but after the fall of the seed (April-May), its nutritive value is reduced by at least half and is equivalent to that of poor European hay. The chief factor is the lack of phosphorus, only 0.08 % of P_2O_5 being present, or one-fifth of the quantity in European hays. When the grass matures, the formation of carbohydrates is more rapid than the absorption of phosphorus from the soil, so that the proportion P_2O_5 rapidly falls. This is the cause of osteophagy, and the administration of compounds containing phosphorus prevents the reappearance of the disease with its deleterious effects on the development of the animals.

Similarly, the consumption of young grass, grown after burning, attenuates the symptoms of osteophagy.

In this connection, the two following deductions may be made:

a) the development of osteophagy in animals varies in inverse ratio to the proportion of phosphorus in plants;

b) the lack of phosphorus is evident during the whole year, but is less pronounced at the beginning of spring, and sometimes is no longer found at this period, when a large quantity of young grass is fed.

Effects of administering different forms of phosphorus. — A rapid diminution of cases of osteophagy is brought about by the use of four compounds containing phosphorus: wheat bran furnishing

it in organic form associated with a relatively small quantity of other mineral matter; bone meal supplying phosphorus in the form of calcium phosphate; sodium phosphate in which the phosphorus is in combination with another base; phosphoric acid, eliminating all bases and making it evident that there is a lack of phosphorus and of nothing else. Phosphoric acid, nevertheless, is not convenient in practice, seeing that it reacts as a fixed acid which disturbs the base-acid equilibrium of the organism.

The most advantageous form is bone meal, which is liked by animals and causes no digestive troubles. Phosphate of calcium precipitate has the same action as bone meal, but is less economic and less appreciated by animals. Wheat bran should be used for cows in milk.

It is interesting to add that a group of cattle receiving *chalk* retained its perverted appetite for bones similarly and to a greater degree than the group under observation, whereas the group fed on bone meal quickly gave up osteophagy. This seems to show that lime should not be added to bone powder. There is on the other hand no lack of lime for plants on the Armoedsvlakte farm, and the addition of lime probably diminishes the absorption of phosphorus during digestion. In addition, other salts have been used: Glauber's salts, Epsom salts, iron sulphate, sulphur, etc... but so long as phosphorus is lacking, osteophagy continues and there is no appreciable effect.

With regard to the effects of phosphatic fertilisers, they are the same; but again, this process is less economical than the administration of phosphorus to animals by means of a richer substance, at least in arid regions and far from industrial centres and ports.

Work which is now being carried on will afford information as to the possibility of explaining the existence of other diseases by soil analysis. We would point to the research work being done in the district of Ermelo, where a disease called "Styfsiekte" is prevalent, the cause of which is certainly a lack of phosphorus, perhaps also of calcium, the etiologic links of which, however, are still unknown.

We have pleasure also in mentioning recent research work of the highest interest, on poisonous plants, on which we heard an interesting lecture, accompanied by lantern slides and microscopical demonstrations, given by Dr. THEILER himself before the Biological Society at Pretoria.

The same kind of poisoning is probably met with in the Belgian Congo, judging from what we heard and saw at the breeding station at Katentania.

As to *lamziekte*, we have not heard of its existence in the Colony. The local soils however, are generally poor in phosphorus, and until the soil has been sufficiently fertilised, there is no doubt that farmers raising milch breeds, would do well to add bone meal to the feed. The selling price of milk — 4 francs a litre — would justify this slight expense. The same addition might be made by pedigree breeders in order to advance precocity. Attention is also drawn to the advantage of using wheat bran.

In concluding this article we desire to call attention to the richness of the documentary matter on tropical diseases which may be consulted at the laboratory at Pretoria.

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MAMMARY MICROFLORA IN RELATION TO CHEESEMAKING.

For a long time past the writer has drawn attention to mammary microflora and has suggested that it has a certain value under normal conditions. Previous writers, including WARD, DINVIDDIE, BOLLEY and HALL, had overlooked the importance of this factor, but gradually it has become a matter for investigation by a number of scientists, by whom the writer's results have been confirmed and amplified.

Special mention should be made of the works published in America by the Agricultural Experiment Stations in the United States and Canada, and in Switzerland by the Federal Bacteriological Laboratory at Liebefeld, near Berne, where in 1901 I made my first investigations on mammary microflora and where my deductions regarding its importance were then received with incredulity by the late Director, Dr. FREUDENREICH, whose views were for some time shared by his colleagues, BURR, BARTHEL, HARRISON, ORLA, JENSEN and KITT.

In response to the invitation from the Direction of the *International Review of the Science and Practice of Agriculture*, the present state of our knowledge of mammary microflora is now given with special reference to hygiene and the dairy industry.

WHAT IS MAMMARY MICROFLORA?

The term " mammary microflora " should be applied to organisms which are constantly found in cows' udders, though the animals be healthy.

There are two classes of lactic microflora, primary and secondary. The primary is that which issues with the milk from the udder, the secondary that which enters the milk from outside sources during, or after milking. This distinction is important in practice because, while the secondary microflora may be kept away by antiseptic milk-

ing, the primary microflora is found in the milk even after antiseptic milking, so that it cannot be eliminated without modifying the physical and chemical properties of the milk itself.

But primary microflora is in turn subdivided into two classes: one of stable and constant character, the other of casual and inconstant character, varying as the microflora which contaminates the outside surface of the udder varies, that is, according to the animals' sleeping quarters (whether they lie on the grass in the meadows or on litter in the stalls, whether the litter consists of straw, leaves, twigs, turf, etc.) and also according to the seasons, fodder, state of cleanliness, etc. (it is, for instance, less prevalent in goats than in cows on account of the different conditions in which they live).

The stable and constant primary microflora, which is indeed settled in the interior of the udder in the centre of the secretory alveolar parenchyma, is rightly called *mammary microflora*, whereas the casual and variable microflora in the lower excretory passages should rather be called *microflora of the milk ducts or teats*. This subdivision is also important in practice; for the microflora of the teats is almost completely expelled with the first milk drawn, hence it is estimated that the greater part of it can be got rid of with the loss of the first twelve jets, equal to about ½ litre of milk; on the other hand the mammary microflora properly so called continues throughout the milking, and is sometimes even more abundant at the end than at the beginning, so that in order to examine it the first portions of milk must be drawn off (the use of the catheter however is inadvisable because it may draw organisms from the milk ducts into the mammary cistern). In short, the mammary microflora is the only flora which persists in the milk in spite of all precautions.

It is to this mammary microflora that my investigations have been directed. Whereas for some time it was considered occasional and capable of being evacuated like the microflora of the teats, it is to-day recognised as regularly and permanently present in the udders of all cows, even of those in normal condition, and hence it has become an integral part of the milk constituents. It is indeed impossible to draw from the udder an appreciable quantity of milk (20-100 cc.) which would be perfectly sterile, so that the opinion that the milk originally supplied by the udder is amicrobic, is untenable.

Whereas this microflora was formerly considered to be quite ordinary and placed on the same footing as the microbes in the air

PLATE XX.

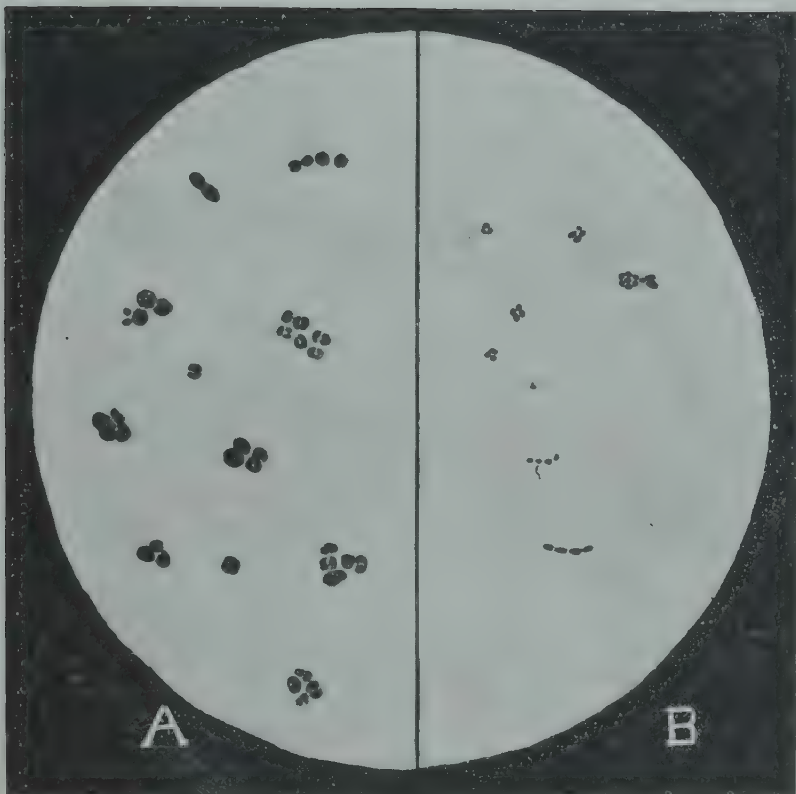

FIG. 52. — Proteolytic acid mammary micrococci (500 diam.).
A. — Dissolving gelatine (*M. casei acidoproteolyticus* I).
B. — Not dissolving gelatine (*M. casei acidoproteolyticus* II).

PLATE XXI.

FIG. 53.—Proteolytic acid mammary streptococci (short chain.)
(Bacterium OLIM Bacillus mammus mammae.)

and in stable dirt, to-day it must be considered an important factor both in sanitation and cheese-making.

Composition of the Mammary Microflora.

The mammary microflora is very simple. Whereas in the teat microflora, as will readily be understood, the most varied species of microbe can be found, the organisms constituting mammary microflora can be connected with two bacterial species only: one, the more frequent, forming the usual mammary microflora, is represented by micrococci (mammary micrococci), the other, the less frequent, is represented by streptococci (mammary streptococci).

The mammary micrococci are characterised by the proteolytic-acid cocci discovered by me in 1901 (fig. 52) which, as I afterwards showed in 1902, may be divided into several types, differing not so much morphologically as physiologically; some liquify gelatine more or less quickly or slowly (fig. 52 A), others do not liquify it at all (fig. 52 B); some are colourless, others chromogenous, yellow or greenish; there are also intermediate and even fluctuating types possessing no differences sufficiently constant and passing easily from one to another type, and which are hence rightly termed *Micrococcus varians* (Conn, Esten and Stocking, 1906).

The mammary streptococci (which culminate in the *Streptococcus mastitis*), also show various types, of which some are also proteolytic; one of the first examples of these is that minute proteolytic-acid rod-like form which was described by me in 1907, according to the nomenclature of the time, as *Bacillus minimus mammae*, but which to-day, as it is not sporogenous, I prefer rather to describe as *Bact. mammae* (fig. 53). It is comparable in form to the elongated lanceolate or fusiform cocci to be observed in *Streptococcus lactis* or *lacticus* which some also denominate *Bact. lactis acidi* or *Bact. Guentheri*; hence I place it among the mammary streptococci, regarding it as akin to that liquefying species of *Bact. Guentheri* which Burri has also traced (1917) in the udder (*Strept. liquefaciens*, of Orla Jensen (1919), akin and not identical because the bacterium peptonises casein and also gelatine, whereas mine peptonises casein only; but these differences with regard to gelatine are met with also among types of other proteolytic organisms, and in the first place among the above-mentioned mammary cocci. Elsewhere I have shown that the failure to liquify gelatine is simply

due to the fact that this substratum is not favourable to the development of the *Bacterium mammae*; the caseolytic enzyme, however, that the organism secretes in milk culture then shows itself capable of liquefying the gelatine. Moreover, among the typical mammary streptococci there are some which are incapable of developing on gelatine plates.

I have carried on my researches up to the present time, both on micrococci and mammary streptococci, examining more than 50 types isolated by myself and 10 types with which my colleagues (BURRI, EVANS, ALICE HARDING, HART, and ROGERS) favoured me; all the cultures were transplanted each week or fortnight into milk sterilised. I had noticed that milk sterilised in the autoclave is ill adapted for determining the proteolitic properties of the bacteria. Naturally, there are also differences between one milk and another.

From all the observations taken I am inclined to consider that no well-defined difference exists between the micrococci and streptococci, for I noted a great variability in morphological characters, the cells of the one and the same type being sometimes isolated, sometimes coupled, sometimes grouped in three groups, in groups or short chains; side by side with spheroidal forms there are elongated forms; their dimensions vary from 0.5 to 13 μ.; all however are gram-positive. I found the same variety in physiological properties; the predominating types are proteolitic both on the gelatine and on casein. But in one and the same type, even in the same colony individuals are found which peptonise only the gelatine or the casein, which liquefy the gelatine slowly or quickly before forming visible colonies, which curdle milk quickly or slowly and also only after boiling, which peptonise milk slowly or at an early stage even without previous curdling, which re-dissolve the curd horizontally or laterally, which are colourless or chromogenous — white, yellow or citron. This explains why the mammary germs are described and named differently by various authors — who desired to name them: *M. lactis varians* Harrison and Savage, *M. lactis albidus* Conn, *M. lactis aureus* Esten and Mason, *Staph. aureus* Sadler, *Strept. liquefaciens* Orla Jensen, *Bact. Guentheri liquefaciens* Burri etc. For my part, from the latest investigations, I also renounce the names I had previously proposed, and prefer to call them simply [illegible] mammary *cocci*.

Besides the above-mentioned micrococci and streptococci, [illegible]

organisms have been found in the stable mammary microflora except the abortion bacterium, which some identify with *Micr. Melitensis*; but the latter being pathogenic is outside the scope of my investigations. All the other microbes which may be found in the primary microflora, that is, in the milk obtained by antiseptic milking, should be classed with the flora of the milk ducts, which, being causal, is very varied and multiplex, just as is the flora of the air and of stable litter. Indeed, side by side with common organisms have been found zymotic germs of every kind, both useful, as the ordinary lactic ferments, and injurious, as the gasogenous or putrifying organisms found both among bacteria (*B. Coli-aerogenes*, *B. Proteus-Zopfii*) and among sporogenous bacilli (butyric ferments, *B. Albolactis*); sometimes also chromogenous organisms (*B. Syncyaneum*) or saccharomycetes, and even actinomycetes (*Nocardia*). All this flora has been found in milk obtained by antiseptic milking, but limited to the first drawings or at most to the middle drawings and very rarely found in the last drawings; in any case always in a transitory and never in a permanent state, thus showing that it is not capable of settling in the glandular parenchyma. On the other hand the mammary cocci and streptococci show a surprising constancy for months and years in every individual udder, or rather in each quarter of the udder. And this constancy is one not only of quality but also of quantity, inasmuch as a certain quarter under normal conditions continually contains the same bacterial species in fairly equal numbers which fluctuate around an average figure. There are generally from 10 to 100 organisms per cc., sometimes there are even less than 10, and sometimes several thousands; only occasionally do they reach hundreds of thousands (GORINI, BURRI).

It is also a noteworthy fact that the various quarters of one and the same udder rarely contain the same quantity of microbes; they generally show differences in quantity and quality not less than those in the udders of different cows; one of the quarters may contain coccic microflora, a second streptococcic microflora, a third, mixed microflora; one of the quarters may be poor, another rich, another very rich in flora and the last even amicrobic. So that each separate quarter of the udder acquires a microbic individuality such that generally in a herd under bacteriological control, the cow from which the samples come may be picked out, by basing on the microbic physiognomy of the four quarters, when once the microflora of the teats has been excluded.

Origin of Mammary Microflora.

The different behaviour of the mammary microflora as compared with the milk duct microflora, showing that the latter differs from the former in not being able to settle fixedly in the glandular parenchyma, leads us to conclude that it is of a different nature. In fact, whereas the casual microflora of the milk ducts is evidently the result of external infection entering through the orifices of the teats, the origin of the mammary microflora admits of two hypotheses; either it also comes from external contamination, or from within the organism. It is a very complex question and difficult to resolve by experiment, seeing the abundant communication which the glandular tissues have with outside surroundings through the milk ducts. It is impossible, in the presence of a positive cultural result, to determine whether the microbes found in a particle of the glandular tissue do not come from the zone which has external communication, the more so that owing to the scarcity of the microbes in the tissue, considerable portions of it must be subjected to examination. Arguments may be adduced however in favour of one rather than of the other hypothesis. If contamination enters from outside, it must be admitted that selection takes place among the exogenous germs within the udder, whereby the two above-mentioned species only can thrive, adapt themselves, and live together in the glandular cells. It is known indeed that the penetration of outside organisms through the teats is followed by phenomena varying according to the number, quality and virulence of the microbes and the resistance of the animal; all the inoculation tests made however show that the mammary glands form a serious obstacle to the penetration and settlement of an external agent. If it is desired to set up specific inflammation of the udder, very heavy doses of infective virus must be injected into the teat; the glandular defensive reaction is expressed in a more or less pronounced inflammatory process which clearly shows itself when common microbes are inoculated, because these are destroyed more or less rapidly. The tests show indeed that it is impossible to cultivate any microbes whatsoever permanently; some authors have injected various bacteria into the udder without causing inflammation (*B. prodigiosum*, *B. fluorescens*, *B. exiguum*, *B. acidi lactici* and others, including the same cocci isolated from the milk obtained by antiseptic milking); they observed that the number

of the organisms present in milk constantly diminishes after the beginning of the test and that the greater part of them have disappeared after some hours ; *B. prodigiosum* was seen to persist longer, even after 8-15 days, but then disappeared also. Thanks to this defensive reaction, ordinary external infection is generally limited in the lower region of the gland to a line not far from its point of departure ; how then, among exogenous organisms could the mammary micrococci and streptococci only be spared ? Perhaps through their greater adaptibility to the mammary surroundings, owing to their power of becoming anaerobes and to their resistance to the temperature of the organism ? But it is impossible that such qualities should be confined to these two species, for among the teat microbes were also found various anaerobic and heat resistant species. It is more feasible to regard them not altogether as saprophytes, but as attenuated races of parasitic species, capable of resisting the bactericidal properties of the organ ; and if inoculation with the respective cultures does not cause them to settle permanently in the udder, probably it is because they are weakened through artificial culture. Nevertheless, contrary to the common organisms of the air and the so-called stable cocci, for which they were sometimes mistaken, probably owing to their chromogeny and their weak acidifying effect on milk, they would always have certain special characteristics, such as facultative anaerobic properties, which comes first in importance, and then the caseolytic (GORINI) and lipolytic activities (BURRI), which in the stable cocci are absent or scarcely noticeable.

But the second hypothesis, not less acceptable, is that the mammary microbes come from within the organism, via the blood or lymph.

The impermeability of the normal intestine has been shown to be maintained even during the period of digestion, but the intestinal mucus, when irritated or slightly injured, allows access to some organisms, and particularly, indeed almost exclusively, to the intestinal cocci, the so-called enterococcus. This explains the contradictory results obtained by the author, by administering to the animals under test, pure cultures of certain bacteria, such as *B. prodigiosum* and *B. fluorescens liquefaciens*, which bacteria were sometimes found and sometimes not, after 2 or 3 days, in the marrow, the spleen, the kidneys and the milk ; everything evidently depends on the condition of the intestine, and, by analogy, also on the conditions of the epithelium of the mammary gland ; and both the pas-

sage and settlement of the bacteria must be facilitated by the parasitical nature of the bacteria themselves.

As a matter of fact, if virulent streptococci be inoculated into the blood-vessels of the rabbit, their elimination by means of the mammary gland takes place for a few days (STECK).

In this connection it is well to remember that many authors put the enterococcus on the same footing as *B. Guentheri* that we have put in the same category with the mammary streptococci, and that the enterococcus has also been recently proved to possess proteolytic rennet-acid properties like the mammary cocci.

It may be concluded therefore that both sources of origin, the exogenous and the endogenous, are admissible for the mammary bacteria, when the latter are taken as being attenuated pathogenic forms.

This conclusion is supported also by the normal intermammary presence of a decidedly pathogenic germ such as the abortion bacillus, analogous to *M. melitensis*; here also some consider it to be an external infection (through the vagina, perinaeum, teats), based on the observation that the hind quarters of the udder are the first to be attacked; which coincides with the general fact, that these quarters very often contain a much richer microflora than the front ones; others consider it to be an internal infection, based on the observation that virulent abortion bacteria injected into the veins of goats appear in the milk within 24 hours.

PATHOGENIC CHARACTER OF MAMMARY MICROFLORA.

The admission of the parasitic nature of the mammary organisms at once brings them very near the pyogenous bacteria, the mammary micrococci being placed in the same group with the pyogenous staphylococci and the mammary streptococci with the pyogenous streptococci and this both on account of their morphological and their physiological affinities. It is admitted in fact that morphologically the micrococci should be grouped with the staphylococci; the mammary micrococci also show types with yellow and lemon-coloured chromogenic tendencies like the pyogenous staphylococci, and vice-versa the pyogenous staphylococci also show types with proteolytic acid tendencies like the mammary cocci, and similarly with the mammary streptococci.

There are not wanting, besides, examples of the inoffensive intramammary vegetation of highly virulent pyococci (STECK).

Not only is the permanent settlement of the above-mentioned organisms in the glandular parenchyma thus explained, but also their numerical constancy in every quarter, as well as the numerical difference between the different quarters of an udder.

For in the case of pyogenous forms, however non-virulent or but slightly virulent, it is only logical to admit : (*a*) that with their toxin they cause a permanent stimulus, which excites in the organ a microbicidal contra stimulus, whence between the action and reaction a state of constant equilibrium is set up, which explains the numerical constancy ; (*b*) that the richness of the mammary microflora is in direct ratio with the bactericidal power of the organ, in the sense that this power is the stronger as the bacterial content is more numerous ; that explains the numerical difference. If this were not so the bacteria would finally develop to such an extent as to cause inflammation. Therefore the organ must be considered as in a permanent state of irritation, so slight and chronic, as to be considered *normal*, since it retains its full regular functional capacity.

As soon as this equilibrium is lost however, whether by diminished organic resistance or by an exceptional growth of the mammary microflora, abnormal conditions are created whereby certain tendencies develop which may go so far as to become actual mastitis ; which leads us to recognise decisively that the mammary micrococci and streptococci are attenuated varieties of pyogenous species. Thus the unforeseen appearance of staphylococcic or streptococcic mastitis is accounted for, whether in cases of diminished organic resistance, as happens after digestive trouble, traumas, overwork or simply fatigue (*suspension of milk*), especially if accompanied by transitory hyperthermia, suffocating or sultry heat, general or merely local chills (the cow lying for instance on cold damp ground) ; or in cases of an exceptional growth of mammary microflora, as happens in consequence of retention or suspension of milking during lactation or during drying up. But here we enter into the pathological field, with fundamental alterations of the lactic secretions, which are outside the scope of my work.

There are nevertheless cases of abnormality of the mammary microflora which do not cause apparent inflammation or alterations of the lactic secretion, but which nevertheless are factors in the preservation of the milk and preparation of milk products. These

cases were explained by my investigations on the relation between mammary microflora and cheese-making.

RELATION BETWEEN MAMMARY MICROFLORA AND CHEESE-MAKING. UNDER NORMAL CONDITIONS.

When in 1892-94 I had shown the existence of rennet-acid bacteria capable of dissolving casein in acid reaction, I perceived in them a special aptitude to help in the process of cheese-ripening, and therefore advanced my *proteolytic acid* theory on this ripening, which reconciled the two conflicting theories as to the simple lactic ferments (FREUDENREICH) and the peptonising ferments (DUCLAUX), adherence to which split investigators into two camps, and which were insufficient to explain the ripening process, since neither the lactic ferments of FREUDENREICH nor the peptonising ferments of DUCLAUX are capable of dissolving casein in an acid medium. In further support of my theory I proved in 1897 that as high temperatures were favourable to saccharolytic activity, low temperatures were favourable to the caseolytic activity of bacteria, such low temperatures as are met with during the ripening of the cheese. And when in 1901 I had proved that proteolytic rennet-acid cocci generally exist in the udder, I deduced thence that the milk issuing from the udder already contains bacteria and enzymes favouring its transformation into cheese. Such cocci indeed are met with in all cheeses and, like the mammary cocci, do not belong to one but to several types, of which I described the two principal under the name of *M. casei acido-proteolyticus* I, fig. 52-*A* (which liquifies gelatine), and *M. casei acido-proteolyticus* II, fig. 52-*B* (which does not liquify it). Such variability of the cheese cocci has also been recognised by several authors.

The cheese cocci are met with in large quantities in the first stages of ripening (fig. 54); afterwards they gradually diminish, without, however, ever disappearing altogether, except perhaps in the case of cheeses of large size, made at high temperatures such as the Emmenthal cheeses, in which it may be concluded that the high temperature, which continues long after their preparation, and the degree of acidity which consequently increases very quickly, hinder the development of these cocci. It should however, be noted that even where a premature disappearance of these microbes takes place, the action of their caseolytic enzymes is maintained and con-

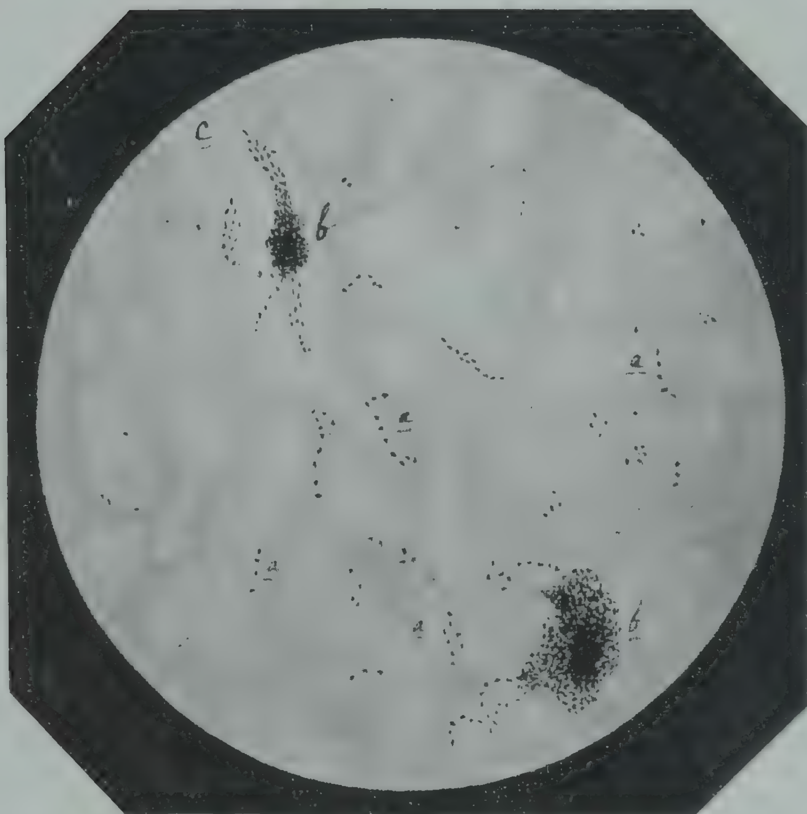

FIG. 54. — Caseary microflora.
Section of Grana cheese — (500 diam.)
a) disseminated bacteria ; *b*) accumulated bacteria ; *c*) serose.

tinues even after the death of the cells, similarly to what is observed in cheeses ripened at a high temperature, where the bacteria in general diminish more quickly than in cheeses ripened at a low temperature, and yet the increase in ammonia continues, even after the bacteria have almost disappeared. And in support of the theory as to the help rendered by such cocci to cheese-ripening, I have also shown that they and their proteolytic enzymes are able to carry on their function even at the low temperatures at which the majority of cheeses are ripened. It should be added that in all probability to the same mammary cocci is due the production of *galactase*, a so-called proteolytic enzyme, pre-existent or natural, discovered in milk by BABCOCK and RUSSELL in 1897, that is, before the existence of proteolytic cocci within the udder was proved by me, whence the American discoverers considered it to be of primitive cell origin. As is now known, the American school, and after them several European authors also, assign an important part to galactase in the digestion of the casein both in hard and soft cheeses. Also the fact that galactase has not always been found in milk obtained antiseptically, favours its bacterial origin ; these are evidently cases of extremely poor mammary microflora ; it has also been found that the milk of the quarters rich in mammary microflora contains a larger quantity of soluble nitrogen as compared with the quarters poor in bacteria (KÖSTLER). It should be added finally that such cocci by peptonising the casein render it utilisable by the simple lactic ferments, thus facilitating the ripening process.

These reasons make it evident that the proteolytic-acid cocci of the udder, in the mass, that is in all their varieties, should be considered as necessary factors of cheese-ripening in general.

Another useful function of the mammary cocci may be perceived in the fact that their digestive enzymes can be placed among the factors of the well-known greater digestibility of entirely new unboiled milk as compared with boiled milk, in which the enzymes are weakened, and this applies especially in the preparation of sanitary milks obtained antiseptically, where the mammary microflora can come into play, not being overcome by the secondary microflora.

It may be said also that in the case of other milk enzymes, the question has arisen as to whether they are not of microbic rather than cellular production ; this applies especially to catalysis, which the proteolytic lactic ferments gave shown themselves capable of producing, in contrast to the simple lactic ferments.

Abnormality of Mammary Microflora.

The mammary microflora have so far, been treated under normal conditions, in which it can and should be considered as without effect on the udder and useful in cheese-making and for milk consumption. But in suceeding works several cases have been indicated in which the microflora should be considered as abnormal and injurious. Cases of disease and of evident inflammation of the udder are excluded; here a decidedly pathological field is entered upon; mastitis or mammitis will definitely affect milk secretion by virulent pyogenous bacteria or specific morbid organisms (tuberculosis, epizootic aphta, small pox, vaccin, etc.).

My investigations have shown that the mammary microflora may be in an abnormal condition without the organ being greatly inflamed. This fact, to which my work first drew attention, has not only been amply confirmed, but considerably developed by various scientists, by whom it has been shown that cows rarely have udders of which all the quarters have a normal microbic content; at least one of the quarters, although there is nothing to show that it is in a different condition from the others, though it yields apparently normal milk, has a microflora not only abnormal but persistently abnormal. The phenomenon of constancy which we saw was one of the characteristics of microflora in a normal condition, is repeated in that of an abnormal condition.

It is a question not only of quantitative but also of qualitative abnormality, not in the sense that there are unusual species, for then we should be entering on the pathological field, but in the sense of such an increase or decrease of the activity of the usual microflora as to become dangerous or injurious, without however attaining pyogenous properties sufficient to cause mastitis.

As determining causes of similar slight abnormalities I have pointed to the slight cases of stagnation or lactic obstruction in the udder in consequence not of a suspension of milking, but simply of imperfect or incorrect milking. By *imperfect milking* is implied that the milk is not completely drawn from the udder especially at the conclusion of milking. By *incorrect milking* is implied that the milk is partially withheld by the cow owing to ill treatment during milking, : it is a well known fact that all ill treatment, such as fright during milking, as also the preliminary palpations with

which the milker seeks to draw the lactic secretion, if carried out roughly or to excess are liable to cause a retention of milk.

Such lactic retentions are generally transitory and pass almost unobserved by the milker, and yet whenever the milk remains in the udder longer than the normal period between each milking, it influences both the number and virulence of the mammary bacteria, because during lactation organic resistence is easily weakened, whence insignificant causes are sufficient to intensify microbic activity.

This explains the increase of the mammary bacteria following on too prolonged pre-milking palpations; hence it is advisable to reduce to a minimum the cleansing operations prescribed for antiseptic milking; however, if milk retention did not enter into the question here, both palpations and washing would have an opposite effect, as they increase the circulation of the blood and thereby the activity of the antimicrobic factors.

The increased microbic development has injurious effects on the udder and on the milk. Such effects are more serious when caused by mammary streptococci, the action of which is analogous to that of the ordinary microbes, but more intense, in that they cannot indeed remain long and in great abundance with impunity in a state, so to speak, of latency like that of the ordinary cocci; that is they are more sensitive to milk stagnation, whence they more easily give rise to a transient form of mastitis, which passes off without needing special treatment beyond more frequent and delicate action in final milking; a pure culture of *B. mammae* was found in one of these cases of transitory mammitis.

The injurious effect of imperfect or incorrect milking is more marked in the case of cows which usually show unwillingness to give milk, or when physiological causes of milk retention are present, such as a diminution of the rate of secretion, especially during the drying off of the udder.

The facility and rapidity with which the numerical oscillations of the mammary microflora and especially of streptococci, can make the mammary infection pass abruptly from the physiological normal state, to the abnormal, if not yet pathological, state, which then abruptly becomes normal again, are remarkable. To detect such numerical oscillations, slight, unnoticeable causes are sufficient, such as the inevitable stagnations which take place spontaneously during the drying off of the udder; these stagnations generally disappear

at calving or with the new lactation period, in spite of the persistent mammary microflora, in which however a tendency to a beneficial change is to noticed when the usual micrococci get the upper hand of the streptococci. On the other hand these stagnations are aggravated when bad drying off preparations intervene with suspensions or insufficient milking, or when these preparations are carried out in udders or udder quarters which have already suffered from incorrect or imperfect milking during lactation.

The danger of the stagnations thus increases, progressively increasing the predisposition to stagnation, and the extent of the consequences following thereon through the mammary microflora, the result being cows which are peculiarly sensitive to lactic obstructions, or as the Germans say, *stauungsempfindlich*. So that it may be said that the stagnation mastites are exclusively in the udders or udder quarters possessing a definite bacterial character, a definite and especially streptococcic microbic history, and that the microbic stagnations, if they existed, would pass off harmlessly. This explains why there are quarters which repeatedly are more open to bacterial invasion, and why certain mammary diseases attack only one quarter, leaving the others immune.

The contrary hypothesis has also been advanced, that is, that the mammary bacteria are left after a progressive mastitis which may have passed unobserved and has then become normal ; but this hypothesis, if it should not always be entirely rejected, can no longer be held after the generalisation of the mammary microflora has been demonstrated even in the most healthy udders, that is those which are not only not in a stagnant state, but which have never previously suffered stagnation nor are liable to it. Unfortunately, after what has been said above, it is obvious that to be sure of finding such udders they must be limited to those of the first lactation and that they become more and more rare with successive lactations. This agrees with the practical observation that the milk of cows which have calved several times shows increasing resistance to fermentation, that it loses its cheese-making quality, though retaining a normal appearance, owing to the effects caused by the abnormal mammary microflora. The best dairies for cheese-making are those which chiefly contain first-or second-calving cows.

Some authors ascribe the success in cheese-making during the war, to the elimination of the older milch-cattle, in spite of the deficiency of the cow-house and dairy staff (KÖSTLER).

Influence of Mammary Microflora on Cheese-Making under Abnormal Conditions.

The effects produced on milk by abnormal mammary microflora consist principally of enzymotic modifications which may be connected, both directly and indirectly, either with a numerical increase or with an increased activity of the mammary bacteria. The direct effects depend on the fact that the milk, though of normal aspect, issues from the udder exceptionally charged with the bacteria themselves or with their respective proteolytic rennet enzymes; the indirect effects depend on the fact that the unusual number or virulence of the mammary bacteria, though not causing actual disease of the udders, cause an excitation, a deviation of their functions, whereby the milk is secreted in a still apparently normal state but modified in its internal enzymatic constituents.

These are modifications which escape observation both under the organoleptic inspection and the ordinary chemical analysis, but which influence the fermenting activity and the cheese-making quality of the milk, as may be observed from its tendency to decompose and its behaviour with rennet, in the zymoscopic-lactic and curdling tests.

In the zymoscopic-lactic test the influence of these modifications is shown in two ways: by the *premature curdling* and by the decomposition of the milk; the latter, according as the curdling or the dissolving action of the mammary microflora prevails, either curdles prematurely, that is before having attained the necessary degree of acidity (*premature curdling*, followed by peptonising), or suddenly becomes soluble even without previous curdling (*dissolution*). Both these phenomena are favoured by the incubating temperature so that they become quite evident at 37-38° C., in which they appears in the course of only 10-12 hours (whereas a normal milk keeps for 24-36 hours). In the case of milk kept at the maximum summer temperature, however, and when subjected to heating for domestic use or cheese-making (as in the manufacture of the Grana cheese), these phenomena may take place prematurely, causing a notable shortening of the period during which the milk may be kept and utilised, with an economic loss to the producer and consumer, not only a financial loss, but the loss of a food for which there are no substitutes.

It is not to be inferred that such phenomena are not often due to

the occasional and secondary microflora, but merely to state that the mammary microflora must be considered as the cause of the loss and waste of milk, even when it is produced with adequate precautions against outside contamination. This matter should be inquired into by the United States where regulations are in force as to the "period of usability" of the milk obtained by antiseptic milking.

In the rennet test, the modifications of the milk appear in two forms, and influence the time occupied in and manner of curdling; the milk is late in curdling or the curd is deficient in plasticity and solidity, does not cut cleanly, frees itself from the whey with difficulty and gives a whey as if only a part of the milk were curdled. The consequences of such abnormalities are that the cheese, insufficiently drained, is predisposed to swelling and rotting; besides the whey in the vat, there is an accessory curdling whereby little clots are formed which no longer combine with the principal part of the curd and form the so-called grains, which pass through the meshes of the strainer, causing a loss in yield of cheese.

The worst feature is that the enzymotic modifications of the milk are not revealed under organoleptic examination, hence the cheese-maker does not notice them until the fermentation stage, or even after fermentation, through the success or otherwise of the results. Certain criterions, are given, it is true, which may lead one to assume their existence, as for instance the presence in the milk of stringy particles, which, however, if not sufficiently large, are not easy to observe, because they do not form a sediment, even when passed through the strainers or filters used for purifying the milk; further, these particles, which consist of masses of leucocytes inherent in the increased cellular reaction through abnormal mammary microflora, do not appear when the microbic abnormality is transitory and the stagnation does not invade the larger milk ducts.

Another criterion might be an increased initial acidity of the milk, which to be of any value should be determined immediately on milking and not simply with the organoleptic aids and with litmus paper, but with the acidimeter; the mammary bacteria however are rarely strong acidifiers; the mammary streptococci themselves, including the *B. Guentheri* or common lactic ferment variety, have proteolytic rather than saccharolytic properties; hence even when in large numbers they do not cause active lactose fermentation, and the milk acidity is rarely increased through the mammary microflora.

A better criterion may be that of tasting the milk when it has assumed a special bitter flavour, thereby approaching what the Germans call *rässsalzige* or *salzig bittere Milch* (salt bitter milk), which is due to mammary inflammation or true stagnation mastitis, where the milk is decidedly salt, bitter and alkaline, and also has a different aspect and a slightly brownish-yellow colour, showing real modifications in its chemical composition (increase of sodium chloride, decrease of lactose and acidity, deficiency of salts of lime, etc.). The milk, obtained towards the end of lactation, when drying off is disturbed by the mammary microflora abnormalities, has a tendency towards *rässsalzige* characters; whereas milk yielded during a physiologically normal drying period has characters rather approaching those of the colostrum. It is thus confirmed that milk with abnormal mammary microflora is a beginning, a preliminary stage of pathological milk, which is produced by accentuated secretion disturbances. It should be remembered that the *rässsalzige* milk also has a high microbicidal power, showing a diminished tendency to bacterial growth, which evidently influences the natural selection and later development of the microflora in the milk.

All this, even in a slight degree, if not sufficient to cause the milk to be withdrawn from direct consumption, is nevertheless sufficient to cause the cheesemaker a series of unforeseen difficulties, which may lead him into error or oblige him to adopt other methods of fermentation; in either case unfavourable results are caused on the quality of the products. Unfortunately, it is this kind of milk, apparently normal, but fundamentally modified in its fermentative qualities, which proves most deceptive in cheese-making, because it is the most difficult to reject when sent to the cheese dairy, the more so that the decomposition scarcely ever affects all the milk of a cow, and still less all the milk of a herd, or the greater part of it, but the milk of certain individual quarters. Further, such milk as is already defiled when it issues from the udder is more dangerous than a milk which becomes defiled after milking, for the modifications which have taken place within the udder can no longer be corrected, whereas subsequent contaminations can be rendered harmless by the aid of timely refrigeration or pasteurisation. I have observed, for instance that such milk even resists the beneficlal influence of ferments selected in cheese making.

It might be thought that when the proportion of abnormal milk is small as compared with that of normal milk, mixing with

the latter serves to neutralize the pernicious effect of the former; but this is not the case, or at least not so altogether. In the less serious cases the cheese, if not a complete failure, turns out to be defective in some part, either in the centre or surrounding areas, thus justifying the opinion of experts that the "infected" milk settles in some parts of the curd and there causes isolated abnormal fermentations, which give rise to partially spoiled cheeses, either rotten in certain parts of the inside or rind (serious spots or holes) or with stringy or spongy masses or cavities or circumscribed fissures, etc. The writer's opinion, based on experience, is that the causes of such failures in cheese-making are more often than is believed, due to mammary microflora in an abnormal condition.

Milk testing as regards Mammary Microflora.

Whenever failures in ripening cannot be attributed to other evident or probable factors, when, especially, there are faults in curdling (tardiness, slowness in hardening, difficult clearing of the curd), which point to an anti-curdling or dissolving principle, an investigation of the microbial and fermentative conditions of the milk of every single cow, even of every single udder-quarter, becomes necessary. This test should be based on the microscopical examination together with zymoscopic and curdling tests and should be *carried out on milk just obtained by antiseptic milking, the first jets having been rejected*. The bacteriological analysis alone is not sufficient because the artificial means of culture do not always allow all the mammary bacteria, especially the streptococci, to develop; further there may be bacteria which, even in relatively small numbers exert considerable enzymotic action, and attention is drawn in this connection to the disproportionately dissolvent coccus described by the writer in 1902, which formed liquefaction rings on the gelatine slides even before the formation of visible colonies.

Also the zymoscopic test alone is not sufficient, because there are cases, though rare, of rich mammary microflora in which the milk keeps for a long time as under normal conditions (microbicidal phenomena?) though proving unfit for cheese-making, by the rennet test, which is really one of the most sensitive and should be constantly employed.

Other tests may be helpful, such as the catalysis test, whether the catalysis be of cellular or microbic origin, the direct microscopic

examination of the milk for leucocytes (BREED), the richness of which is generally in proportion to the microbic richness, but when stagnation is limited to the wide milk ducts with an increase of migratory bacteria, it may not be accompanied by corresponding leucocytosis.

Such zymoscopic microscopic control of the endomammary microbial conditions has been advised by the writer for some time, even as a preliminary measure, in order to obtain a healthy *selection of cows*, selection being based on their mammary microflora, especially for the so-called sanitary milk obtained by antiseptic milking and used as children's and invalids' food, whether given raw or pasteurised or sterilised. The writer has shown the peculiar resistance that the mammary bacteria, though not sporiferous, offer, owing to the coating of casein which they acquire through their own coagulating enzymes. This proposal met with the approval of the International Dairy Congress at Bern in 1914, as a subsidiary measure for the veterinary control of milk in view of the connection between the abnormal conditions of the mammary flora and the predisposition of udder to inflammation. Such control should also be instituted in the sale and purchase of, and prize competitions for cows, in view of the quantitative and still more the qualitative persistence of the mammary microflora in certain cows, which is such as to be a more or less permanent characteristic, probably connected with almost abnormal individual conditions, though free of disease.

The microscopic zymoscopic control of milk in connection with mammary microflora should also serve as a standard in the improvement of the herd. The harmful effect of the mammary microflora during the drying off period of the udder increases its liability to stagnation and heightens the anticaseous consequences and should especially be borne in mind.

To combat the dangers of the mammary microflora it is necessary above all to instruct the dairy staff in the care of the udder and in milking. It is not sufficient that milking should be carried out with due regard to cleanliness (the washing of hands and udder) to prevent the milk being infected from outside and through the teats, the more so that the possibility is by no means excluded that the mammary infection comes rather from within through the lymph and blood ; but the milking should be carried out correctly and completely, to prevent those stagnations which render the mammary microflora injurious and cause it to pass from the normal to the ab-

normal state, whether it comes from outside or from within the organism.

In a word, the staff should be instructed that the mammary microflora does not depend so much on the hygienic conditions of the cowhouse and the cows as on milking.

Summary.

The mammary microflora, to which the writer was the first to call and sustain attention both in connection with sanitation and cheese-making, has now been definitely shown to possess the following characteristics : constant settlement in the mammary parenchyma, typicalness, quantitative and qualitative constancy, parasitic nature, importance in cheese-making. It is thus distinguished from the microflora of the air and cowhouse dust and dirt, which may be found in the lower excretory ducts of the udder.

The mammary microflora is essentially formed of micrococci and streptococci which are characterised by proteolytic acid and lypolitic activities and are related to the *Staphylococcus pyogenes* and *Streptococcus pyogenes* species, of which they may be attenuated types, coming from outside or from within the organism.

Owing to the great morphological and still greater physiological variability of these bacteria, whence they have been described and named differently, they can be conveniently termed *cocci mammarii* authorities.

The mammary microflora, which under normal conditions must be considered as having no injurious effects on the udder and as useful in cheese-making, may, under abnormal conditions, become injurious to the extent of causing mastitis. Before however assuming pathogenical properties against the organ, it may, owing to the number and virulence of the enzymes become injurious to the preservation and fermentation of the milk, both from the direct action of the mammary bacteria in the milk and from the cellular reaction caused by them within the udder, whereby the latter, though apparently healthy, has its functions altered so that it secretes milk which, though apparently normal, is affected in its fermenting and cheese-making properties to such an extent as to cause more loss than is believed of milk and failure in cheese-making and in the preparation of sterilised preserved or condensed milks.

To determine the abnormal conditions in the mammary microflora having anticaseous effects on the milk, the obvious causes (digestive troubles, chills, fatigue, etc.) are not exclusively necessary; the lactic states which follow, unfortunately too frequently and unforeseen, imperfect and incorrect milking are sufficient; hence to produce milk, healthy and good for cheese-making, clean and antiseptic milking is not sufficient; in addition milking must be carried out completely and correctly, it being borne in mind that the primary mammary microflora depends on the milking.

To control the fermentative and caseous properties of the milk, which depend on the mammary microflora, the ordinary chemical-organoleptic examination is of little use; it needs a complex zymoscopic-microscopic and caseo-zymoscopic examination of the milk taken antiseptically from separate quarters of the udder, the first jets having been excluded.

This method of investigation will supply valuable criterions, both for explaining failures in cheese-making, and for the acquisition, award of prizes for and renewal of milch cows as well as for their selection for cheese-making, and especially for the preparation of hygienic preserved milks.

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THE PHYTOPATHOLOGICAL PROBLEM IN BELGIUM.

Different countries naturally take different parts in the conspicuous efforts that are now being so generally made to develop Phytopathology in its applications to Agricultural Science.

It is extremely interesting to see the comparative studies of the hygienic conditions of the crops in the various countries that are being carried out with all the care and thoroughness that scientific method requires, and also the reports that are issued on the policies pursued in regard to crop protection, as well as on the further developments which appear to be desirable in the future.

Such work can lead only to a healthy rivalry ; progressive countries find therein the sanction for their labour and efforts, the more backward an incentive to activity, and thus the elements of valuable mutual instruction for all are introduced.

Hence on all general grounds I cannot but be glad of the opportunity of addressing you on the Problem of Phytopathology in Belgium. My pleasure is however somewhat tempered, for against my patriotic inclination, it has to be admitted that in this respect my own country of Belgium takes but a humble place among the nations.

In Belgium, questions relating to plant diseases have not up to the present aroused the interest shown in them in other progressive countries.

There are, perhaps, extenuating circumstances to account for this comparative indifference.

First, the conspicuous success in most forms of plant production is the reason why so little interest is taken in factors which appear to be of secondary importance in obtaining a high yield ; there is also the fact, as will be clearly shown, in the account that will be given of the hygienic condition of the crops, that there are hardly any instances in Belgium of those really dangerous epiphytes which cannot fail to arouse public opinion and cause action to be taken by the authorities.

This comparatively privileged position is due to various causes: first to the fact of a temperate climate, with no extremes, and favourable to plant growth and also incompatible with any special development of parasitic growths, and secondly to the great variety of crops, the result of which is that epiphytes do not find material in abundance for their greater diffusion such as exists in countries where there is a more or less characteristic monoculture covering large areas.

In any case, a certain feeling of security has thus been created in Belgium, which is somewhat prejudicial to the success of a campaign for the complete and systematic organisation of the protection of plants, the importance of which has long been fully appreciated by countries that have suffered severely from cryptogamic and insect pests.

After this introduction, I now propose to make a brief statement on: (1) the hygienic condition of the principal crops cultivated; (2) the organisation for the protection of crops.

(1) Hygienic conditions of crops cultivated

Agricultural Crops.

(a) *Cereals.*

Wheat. — The greatest enemy of wheat is Caries, which still causes an average loss of 5 % of the yield, especially in the case of crops grown on a small scale. On most of the large farms, the seed is very frequently disinfected either by copper sulphate (immersion or spraying) or by formalin.

Take-all, caused by *Ophiobolus graminis*, much more seldom by *Loptopsphaeria culmifraga*, comes second in importance; after mild winters and wet springs it sometimes assumes very destructive proportions; this was the case in 1923.

Naked smut, caused by *Ustilago Tritici*, is rarely widespread.

Only in very exceptional cases is wheat seriously affected by rust. Whereas brown rust (*Puccinia triticina*), the development of which is but little affected by meteorological conditions, appears every year, and only causes very slight damage, yellow rust (*Puccinia glumarum*) and black rust (*Puccinia graminis*) are more inconstant and at the same time more destructive. The former mostly

makes its appearance after a cold wet spring (1923), when it is frequently met with in abundance on the stems but only rarely attacks the ears and never so intensively for instance as in Scandinavian countries. *P. graminis* develops during the years in which vegetation and maturation are delayed by prolonged summer rains (1924), without however generally assuming a disquieting epidemic character.

Barley. — Naked smut (*Ustilago nuda*) and covered smut (*U. Hordei*) are often co-existent in the fields, the second being generally more abundant. But the cryptogamic disease most destructive to barley is, without question, Helminthosporiosis (*Pleospora trichostoma*) which sometimes destroys as much as 25 % of the ears. In spite of the propaganda carried on as to the value of disinfecting the seed, up to the present this is not done on a large scale.

Rusts cause little damage to barley. Dwarf rust (*Puccinia simplex*) appears every year, but is almost innocuous, while yellow and black rust are rare.

Rye. — Stem smut (*Urocystis occulta*) is frequently met with but always in small quantities. Crops are generally free from ergot (*Claviceps purpurea*); here and there it is met with to a small extent.

The leaves of rye are often extensively affected by *P. dispersa*, through the crop does not suffer greatly therefrom; *P. glumarum* is very rare on this cereal and *P. graminis* is met with under the same conditions as in the case of wheat.

Oats. — This cereal is often quite immune from cryptogamic attack. Smut, caused only by *Ustilago Avenae*, is sometimes met with in small quantities. *Helminthosporium teres* var. *Avenae* is sometimes rather abundant and causes partial sterilisation of the panicle. Among rusts, crown rust (*P. coronifera*) is most frequent, black rust being abundant only on late crops which have been subjected to the action of prolonged summer rains.

It should be noted that *Fusarium* sp., so destructive to cereal crops in many countries, are almost unknown in Belgium.

(b) *Roots.*

Potatoes. — This vegetable is attacked by ever-increasing varieties of enemies.

Blight (*Phytophthora infestans*) and the bacterial diseases which frequently follow it appear, so to speak, every year, but assume the

proportions of a serious epidemic only about once in five years, when rains followed by heat prevail at the flowering period. The year, 1924, was marked by a heavy attack of blight.

The copper treatment is scarcely employed except in Lower Belgium, where the sea climate is particularly favourable to the de-development of the disease. Elsewhere it is considered sufficient to select varieties which are comparatively immune from attack, such as Industry, Roode, Star, etc.

The following cryptogamic diseases are also generally met with; bacterial scab is very prevalent especially in sandy, dry soils; powdery scab, (produced by *Spongospora subterranea*), on the contrary, is still very rare; black leg disease, especially in gardens too heavily manured or treated with sewage; winter rot (*Nectria Solani*) and various *Fusarium* sp. on in-growing wet tubers and those kept at too high a temperature; verticillium wilt (*Verticillium alboatrum*) especially in light soils and on certain varieties, such as the Eigenheimer; collar fungus (*Hypochnus Solani*), only slightly harmful as a rule.

Poisonous diseases, represented by the many forms of degeneracy (mosaic, curling, mottling, streaking, etc.) diminish production more than cryptogamic diseases, properly so called, and are especially menacing for the future.

This state of affairs calls for urgent attention and a campaign for the production of a regenerated plant. Several areas, especially Ardenne, up to the present still comparatively little affected, and possessing a climate but little favourable to the development of poison-carrying plant lice, would be suitable for experiments on potato selection.

Beets. — Unlike the potato, this plant is generally healthy in our country.

Beet and mangel rot (caused by various parasites: bacteria, *Pythium de Baryanum, Sphaerella tabifica*) is not frequent, peronospora (*Peronospora Schachtii*) is rare, heart rot (*Sphaerella tabifica*) is more frequent, especially with a dry summer.

With regard to the maculicular parasites on leaves, they are sometimes quite absent when the plants are taken up; some years, however, they are abundant, but, developing late, they do comparatively little harm. Of these, the following are given in the order in which they appear most frequently: *Pleospora putrefaciens, Cercospora beticola, Uromyces Betae, Ramularia Betae, Phyllosticta Betae.*

C a b b a g e s, t u r n i p s, and m a n g e l s sometimes suffer more or less from finger-and-toe (*Plasmodiophora Brassicae*), black rot (*Pseudomonas campestris*) and mildew (*Erysiphe polygoni*).

(c) *Industrial plants.*

H o p s. — Hops may be attacked by mildew (*Sphaerotheca humuli*) and by *Apiosporium* sp.

F l a x. — With the exception of the scald caused by *Asterocystis radicis*, which is common in the endemic stage in Flanders, flax is almost immune.

T o b a c c o. — With the exception of mosaic, tobacco is rarely attacked by cryptogamic diseases.

(d) *Forage plants.*

C l o v e r. — Has many enemies, among which the mildew disease (*Sclerotinia Trifoliorum*), which sometimes causes serious damage after mild and wet winters, and leaf-spot (*Gloeosporium, Caulivorum*), which came from America in 1901 and is extending, should be mentioned.

Peronospora (*Peronospora Trifoliorum*) and oidium (*Erysiphe polygoni*) are never abundant ; and cases of dodder (*Cuscuta minor*), are rare.

Market Garden Plants.

There are some important cryptogamic enemies to the cultivation of these plants, which are very prevalent in certain districts of the country, especially in the neighbourhood of large towns.

We will especially call attention, with regard to tomatoes, to mildew, against which copper spraying is resorted to, bacterial disease (*Phytobacter. Lycopersicum*) and leaf rust (*Cladosporium fulvum*) ; with regard to celery, leaf scorch (*Septoria Petroselini Apii*) ; with regard to beans, pod scab (*Colletotrichum lindemuthianum*) ; and with regard to the strawberry plant, to leaf blight (*Sphaerelle Fragariae*).

Fruit trees and Bushes.

The A p p l e t r e e. — Apple scab (*Venturia inaequalis*) often damages crops seriously, especially after a wet spring (the last

fortnight in May is an especially critical period). Preventive treatment, for which Bordeaux mixture is used in preference to Californian, is scarcely yet in general use in the orchards.

Powdery mildews (*Podosphaera leucotricha*) are on the increase, especially in the case of certain varieties of apple. Canker (*Nectria galligena*) frequently renders unproductive certain varieties planted in compact and, especially in acid soils.

Brown fruit rot (*Sclerotinia fructigena*) does not attack the young shoots, but often rots the fruit on its approach to maturity or, later, during the first months of its storage.

Rotting of wood and trunk caused by polyporaceae is rare; on the other hand tree root rot caused by *Armillaria mellea* is rather frequent, and on pear-trees also, but this parasite does not generally attack stone fruit.

P e a r - t r e e. — Pear scab (*Venturia pirina*) is the most serious enemy. Leaf mildew (*Mycosphaerella sentina*) is very frequent, but appearing late and only affecting the leaves, is much less harmful. Pear leaf cluster-cup (*Gymnosporangium sabinae*) is only found where its teleutospore host, the Sabine juniper, exists in its near neighbourhood.

C h e r r y - t r e e. — It suffers from the attacks of grey blight (*Sclerotinia cinerea*), the acid varieties of cherry being particularly subject, especially the Northern Cherry, the leafy shoots and flower of which are often killed in spring.

P l u m - t r e e. — It is generally free of disease in the early stages of growth. Necrosis of the branches, caused by *Cytospora purpurescens*, is rather rare, as is also the stem disease caused by *Stereum purpureum*.

On the other hand, the old plants often perish progressively through the destruction of the wood of the branches and trunk by *Polyporus ignarius* var. *fulvus*.

Blister Disease (*Taphrina Pruni*), witch's broom (*Taphrina Insititiae*), leaf brown (*Phyllosticta prunicola*), blight (*Puccinia Pruni spinosae*) rarely do any serious harm.

P e a c h - t r e e. — Leaf blister (*Taphrina deformans*) is a serious enemy; oidium and gummosis leaf disease (*Coryneum Beyerincki*) do much less harm.

A p r i c o t - t r e e. — The apricot-tree, which is little cultivated is generally immune from cryptogamic diseases.

Walnut-tree. — The fruits and leaves are often spotted with black from *Gnomonia leptostyla* and it sometimes perishes from the attacks of various polyporaceae.

Chestnut-tree. — But little cultivated, it is, contrary to what has been said, still exempt from the attacks of the dangerous canker parasite *Endothia parasitica*.

Vine. — Cultivated under glass over wide areas, especially in the neighbourhood of Brussels; serious enemies to the vine are powdery mildew (*Uncinula necator*), which is systematically treated by sulphuring, and grey mould (*Sclerotinia Fuckeliana*).

Grape mildew (*Plasmopara viticola*) does not develop in the hothouse, but is frequently observed in the open air on trellis vines.

Currant-tree. — The currant-tree, sometimes extensively cultivated, has greatly suffered since 1909 from the attacks of American gooseberry mildew (*Sphaerotheca mors-uvae*); it does not yet exist everywhere, certain districts, very limited indeed, such as the Namur region, being still immune. The potassium sulphide treatment gives excellent results everywhere.

Leaf spot (*Pseudo-peziza Ribis*) sometimes causes the premature fall of the leaf of currant-trees, and is then, consequently, very harmful.

Forest and ornamental trees.

Though the old populations, which are nearly all deciduous trees, well adapted to local conditions, scarcely suffer at all from cryptogamic parasites, such is not the case with those often planted under conditions which but imperfectly fulfil the requirements of plant-life, especially of many groups of exotic resinous species.

Thus the oak, with the exception of mildew (*Microsphaera Alni* var. *quercina*), which has been prevalent in nurseries and on the summer shoots of copses since 1907, has no very serious cryptogamic enemies; neither has the beech, nor the majority of the other native deciduous species. It should be noted that the elm has suffered since 1919, and especially in 1924, from the curious disease studied at Wageningen by Mlle. Spierenburg, a true sclerosis, of which the causes are still quite unknown.

On the other hand, the Scots pine (*Pinus sylvestris*) has many enemies. Among these, pine leaf cast (*Lophodermium Pinastri*), especially disastrous in nurseries, attacks it in the earliest stages;

later pine branch twist (*Melampsora pinitorqua*), root rot (*Armillaria mellea*) and conifer root rot (*Fomes annosus*), are among the more important. It should be noted that *Trametes Pini* which ravages the old clumps of Scots pines in the Baltic plain and the mountains of Central Europe, has not yet been observed in Belgium.

The Weymouth pine is gradually disappearing under the attack of the disastrous pine rust (*Cronartium ribicolum*), in the absence even, it appears, of its teleutosporian host, the currant-tree.

The spruce suffers less than pines ; needle blight (*Chrysomixa Abietis*), needle disease (*Lophodermium macrosporum*), leaf blotch (*Ascochyta piniperda*) seldom do much damage. Very few species of firs are grown. The future of the larch seems to be irremediably compromised by the attacks of canker (*Dasyscypha Wilkommii*) which is much more virulent in our country than in its native mountains.

(2) Phytopathological Organisation.

(a) *Research Institutions.*

State Phytopathological Station at Gembloux.

This institution was founded in 1894 in the Plant Biological Laboratory of the late Prof. Emil Laurent, who requested me to study the cases of cryptogamic diseases which he observed or which were submitted to him by cultivators.

A very modest Phytopathological Service was thus created, and it was officially recognised in 1900 and raised to the status of a Research Station in 1912, within the limits of an Agronomic Station, and under the name of the " State Phytopathological Station ".

Nevertheless this elevation to an administrative hierarchy, though followed by improvement in the material equipment of the laboratory, was not attended by any development of the working capacity of the institution, the budget remaining at a ridiculously low figure and its scientific staff reduced to a minimum.

Let us briefly examine the proofs of activity of which the Phytopathological Station at Gembloux has, in spite of these drawbacks, been the seat.

Information Department. — In spite of its being absolutely gratuitous, those interested rarely avail themselves to any great extent of this Service. The maximum number of

written consultations (292) was registered in 1913; the yearly average is not above 150.

It should be noted that inquiries are mostly received from private horticulturists who desire information respecting the enemies of their fruit-trees and vegetables.

Laboratory Research and Practical Tests. — Apart from an annual report giving the principal phytopathological observations and the results of practical tests, which for pecuniary reasons, ceased to appear after 1920, I have published since 1894 the following works on theoretical and applied Mycology :

1894. — Sur quelques champignons nouveaux du Congo. (*Bull. Soc. belge de Microscopie*, Vol. XX, p. 259).

1901. — Recherches biologiques sur une Chytridinée parasite du Lin. (*Bull. de l'Agriculture*, 46 pp.).

1901. — Influence des sels minéraux nutritifs sur la production des nodosités chez le Pois. (*C. R. de l'Acad. des Sciences de Paris*, Vol. CXXXIII, p. 1032).

1902. — De l'immunisation de la Laitue contre le " Meynier ". (*Idem*, t. CXXXV, p. 1067).

1902. — De la spécialisation du parasitisme chez l'*Erysiphe graminis*. (*Idem*, Vol. CXXXIV, p. 210).

1902. — Contribution à l'étude du champignon du caryopse des Lolium. (*Bull. de la Soc. de Bot. de Belgique*, Vol. XLI, p. 61).

1903. — De la spécialisation du parasitisme chez l'*Erysyphe graminis*, 2nd note. (*C. R. de l'Acad. des Sciences de Paris*, Vol. CXXXIV, p. 1068).

1903. — Recherches sur la rouille des Céréales. (*Bull. de l'Agriculture*, 40 pp.).

1908. — Une maladie nouvelle du Poirier. (*Bull. de la Soc. Royale de Botan. de Belgique*, Vol. XLV, p. 343).

1909. — De l'apparition, en Belgique, du *Sphaerotheca Mors-Uvae*. (*Idem*, Vol. XLVI, p. 337).

1921. — Contribution à l'étude des champignons fructicoles de Belgique. (*Idem*. Vol. LIV, p. 109). En collaboration avec E. Marchal.

1922). — Champignons parasites nouveaux pour la flore belge récoltés en 1915-1918. (*Idem*, Vol. LV, p. 47). En collaboration avec F. Sternon.

1923. — De l'homothallisme de quelques Ascomycètes. (*Bull.

de la Classe des Sc. de l'Acad. Royale de Belgique, nº 1, janvier). En collaboration avec E. MARCHAL.

1924). — Sur les rapports existant entre des formes conidiennes du type *Ramularia* et le genre *Entyloma*. (*Bull. de la Soc. Royale de Bot. de Belgique*, Vol. LVII, p. 51). En collaboration avec M. F. STERNON.

1924. — De la prétendue existence, en Belgique, de l'*Endothia parasitica* du Châtaignier. (*Congrès de l'Ass. franç. pour l'Avancement des Sciences, Liège*).

1924. — De l'emploi du carbonate de cuivre pour la désinfection du grain dans la lutte contre la carie. (*Idem*).

Other institutions for research.

The Agricultural Institute of the Catholic University at Louvain has a Chair of Applied Cryptogamy, the holder of which, Canon BIOURGE, is carrying on valuable work in Microbiology, but no special research work is carried on at the University in Phytopathology.

The instruction given at the Flemish Agricultural Institute, founded at Ghent in 1920, also includes a course of Botanical Pathology, under M. Van HOVE, Chief of the Phytopathological Inspection Department, for which a laboratory for research work has recently been equipped. At the Horticultural School at Vilvorde a laboratory for the study of horticultural plant diseases has also recently been organised, under the direction of Professor SEGHERS. These institutions, which are still in their infancy, have not yet achieved any important work.

It should be noted that the State Botanical Gardens at Brussels have had on their staff mycologists who have treated various problems in Plant Pathology, of whom the late Custodian P. NYPELS is deserving of special mention.

b) *Phytopathological Legislation and Phytopathological Inspection Department.*

Previous to 1912, Belgian legislation for the protection of plants was almost non-existent, there being laws only for the destruction of thistles and caterpillars.

The law of 27 June 1912 made it possible to adopt severe

measures for preventing the introduction into the country of insects or other animals, and cryptogams or other plants harmful to crops.

Thanks to these new provisions, and under pressure of the restrictive measures adopted by the United States against the importation of Belgian horticultural products a Phytopathological Inspection Department was organised.

Finally, decisions have recently been taken with a view to controlling the woolly aphis (*Schizoneura lanigera*) and the American mildew on the currant-tree (*Sphaerotheca Mors-Uvae*), and for regulating the importation of potatoes in order to prevent the country being invaded by the *Doryphora decemlineata* and *Synchytrium endobioticum.*

The Phytopathological Inspection Department known in Belgium as the "Special Phytopathological Department" undertakes to inspect: (*a*) the horticultural establishments, properly so-called, every six months; (*b*) the horticultural and agricultural products intended for exportation, for which a phytopathological certificate must be obtained; (*c*) the horticultural and agricultural products which it is proposed to import without certificates.

The staff of this Department at present includes: an Inspector, Chief of the Department; an Assistant-Inspector; an expert; five assistant-experts; eight Members of the State Council of Horticulture are also attached to the Department as assistant-experts.

CONCLUSIONS.

A general survey of the phytopathological problem in Belgium leads to the following conclusions:

The sanitary state of crops is, on the whole, comparatively satisfactory and really disastrous cases of disease are rare.

The phytopathological factor should nevertheless be taken into very serious consideration especially at the present time, when there is urgent need to intensify in every possible way all forms of crop production.

In order to reduce the very considerable losses caused by the phytopathological factor, it is necessary:

(1) to develop the working equipment of the Phytopathological Research Institutions in order to enable them to study the diseases which attack crops and to determine the local conditions under which

the evolution of the parasites takes place, which is indispensable for establishing a scientific scheme of control;

(2) to insure a close collaboration of these phytopathological research stations with the Meteorological Departments and Research Station for the Improvement of Cultivated Plants, in order, on the one hand, to determine the relations existing between the course taken by diseases and meteorological conditions, and on the other hand, to endeavour to produce varieties which offer resistance to the principal diseases;

(3) to complete and revise the legislation on the supervision of plant hygiene and to develop the Phytopathological Inspection Department so as to extend its competence and action to all forms of plant production;

(4) to organise an active campaign for diffusing a knowledge of plant diseases and the means of controlling them in a practical way.

EM. MARCHAL,
Director of the State Phytopathological Station, Gembloux.

INTERNATIONAL ASSOCIATIONS

PROCEEDINGS OF THE INTERNATIONAL SOCIETY OF SOIL SCIENCE.

Papers.

APPARATUS FOR SOIL VOLUME DETERMINATION.

With the object of obtaining the most accurate results possible in volume and pore space determination, especially as regards soil types under natural conditions, FROSTERUS (1) constructed an apparatus in which the volume of the sample is displaced by mercury. With this apparatus accurate results could be obtained, but the determination process involved loss of time through weighing, especially in the case of small samples. As the apparatus was made in Helsingfors during the War, it left something to be desired in the matter of material and finish. With the object of improving the original apparatus, FRAUENFELDER attempted to simplify it, so that the displaced volume could if possible be measured without weighing, and long calculations be thus avoided.

The apparatus shown below is the result of the proposed alterations.

Description of the apparatus. — The apparatus consists of three principal parts (Plate XXIII, fig. 55):

1) *The volume determination cylinder.* — This consists of an upper cover and a lower part (B). The top part is fastened by means of three lever clamps to the foot, so that the marks on either part pass one over the other. The pointed apex of the cover passes up into a tube, at the end of which there is a tap *b*. In front of this outlet in the cover a glass tripod is attach-

(1) BENJ. FROSTERUS, *Geol. Komm. in Finland: Agrogeologiska kartor*, Vol. [illegible], Pt. 22, 1916, 168) I. 1.

PLATE XXIII.

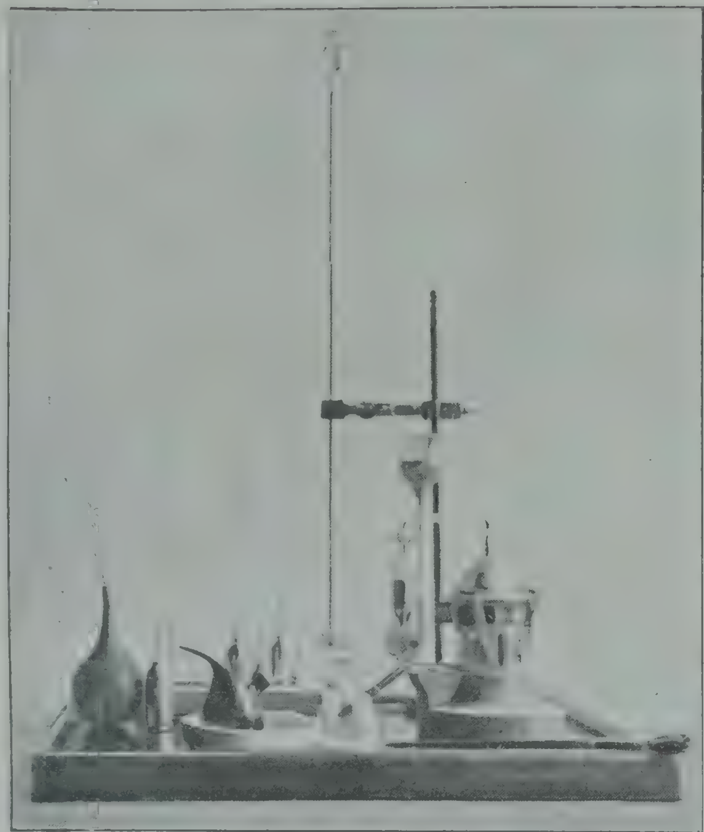

FIG 55. — Frosterus and Frauenfelder's apparatus for soil volume measurement.

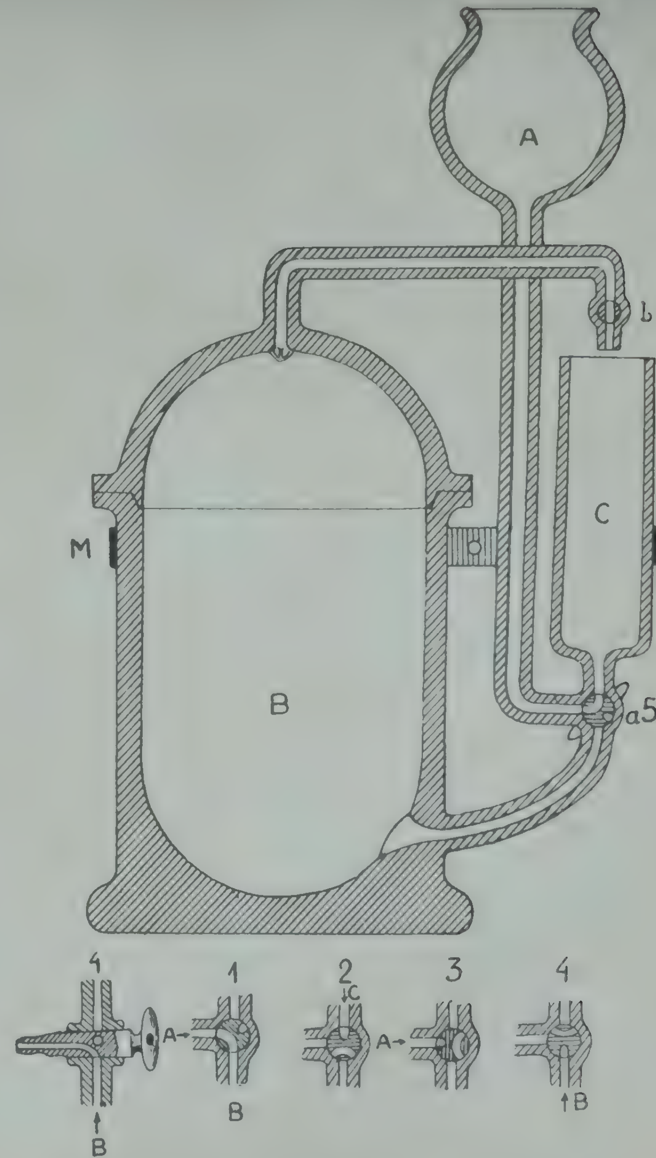

FIG. 56. — Complete apparatus with pycnometers and burette.

ed to prevent the sample from coming into contact with the outlet. From the lower part B a tube issues as far as tap *a*, where the filling funnel A and the continuation of the cylinder C, which lies under tap *b*, branch off.

The inner diameter of B is 50 mm. and its height 100 mm., so that samples up to 100 cc. can be determined.

In order to avoid the breaking of parts A and C, these are attached to the lower part B with the metal band M, to which the lever clamps are also fastened.

2) *Pycnometers.*

3) *Burette.*

In addition to the pycnometers and burette the apparatus includes a mercury pressure-guage.

Manipulation of the apparatus. — The mercury enters the cylinder from below, whereby the bubbles adhering to the glass are expelled.

The filling is done in the following manner:

The tap *a* is turned off against B (position 2), and the funnel A, filled with mercury and *a*, are brought slowly into position 5. *a* and C are thus placed in communication and the air under the mercury in A is driven out. Now tap *b* must be opened and the space B can, in *position* 1, be filled through A until the excess runs through *b* towards C.; *b* is then closed. The excess in C is then allowed to run out, *position* 2. Tap *a* is lengthened by a piece of tubing about 12 cm. long, so that the mercury may be allowed to flow easily and without loss into a vessel; the mercury in A is likewise expelled by *position* 3. The apparatus is now ready for use. The collecting vessel with the excess mercury is removed and another put in its place. Tap *b* is opened and *a* brought into *position* 4, so that sufficient mercury may be allowed to flow out of B to leave the cover free. The three springs pressing tightly on the cover are then loosened and the latter is removed. The sample, of which the volume is to be determined, having been weighed, is placed on the mercury, the cover is closed, and the filling begins as before (the air being expelled by *position* 5) in the positions 1, 2 and 3. The overflow now collected corresponds to the volume.

In order to determine this volume as exactly as possible. *pycnometers* were found to be most suitable. A series of 6, of 50, 25, 20, 15, 10 and 5 cc. were used. Volumes below 5 cc. were measured in a burette of 5 cc. cubic content by 50 cm. in length, so that $^1/_{100}$ cc.

can be determined very accurately. The upper part of the burette expands in the form of a bulb.

The filling of the pycnometers is best done in a small flat evaporator with a vent. There is also a brush and rubber ball for blowing out the mercury remaining in the taps and tubes. The apparatus is emptied by first opening tap *b* and then bringing tap *a* into *position* 4; this position is shown in fig. 56, to the left, in the longitudinal section.

After the removal of the sample, dust, sand, soil and other impurities are often found to be floating on the mercury. These may be removed with a piece of wadding.

If samples soaked with paraffin are tested, the apparatus must be cleaned more often.

Accuracy of the apparatus. — The results are given under the following formulae:

Weight of the sample	w in grams
Volume	v in cc.
Volume-weight	*w*
Specific weight	s
Pore space (in %).	$\frac{(s - \frac{w}{v})\, 100}{s}$

The specific weight of porous substances (checks) is determined, as usual, with the pycnometers.

In order to test the accuracy of the apparatus a number of samples were repeatedly determined.

A red quartzite on which 10 determinations were made on different days, always gave the same results:

Weight of the sample	37.120 gm.
Volume	14.600 cc.
Volume weight	2.54

The greatest errors occurred with porous, non-paraffin substances. For instance, a quarternary clay brick, gave 3 determinations out of 10 which showed 0.015 cc. in excess of the others.

Weight of the brick	49.770 gm.
Vol.$_1$ (7 readings)	25.650 cc.
Vol.$_2$ (3 »)	25.665 »
The volume-weight$_1$ is therefore	1.940
and the volume-weight$_2$	1.939
The specific weight was	2.55

$$\text{Pore space}_1 \; \frac{(2.55 - 1.94)\,100}{2.55} = 23.92\,\%$$

$$\text{Pore space}_2 \; \frac{(2.55 - 1.93)\,100}{2.55} = 23.96\,\%$$

The difference is therefore 0.04 %, in the most unfavourable conditions, i. e. when the volume weight of 1.939 is not raised to 1.94.

This, so far the greatest difference shown, naturally arose only from the fact that the porous check was non paraffin, and for this reason mercury penetrated it and escaped measurement.

The application of the apparatus. — The apparatus is adapted for testing : Soils, minerals, various kinds of stone, potter's clay, artificial stones (beton or concrete), etc.

A number of examples are given below :

Pore space	Specific weight	Volume weight	SAMPLES
			Soil types.
57.5	2.66	1.13	Gystje type Postglacial clay, Odnaes, Pojo.
43.1	2.69	1.53	Postglacial clay, Aeminne - Halikke.
39.8	2.61	1.57	Glacial band clay Vestankvarn.
40.2	2.73	1.63	» » » Pargas.
39.1	2.73	1.66	Mo, Odnaes - Pojo.
37.2	2.71	1.70	Light mjaela clay, Mustiala
31.9	2.72	1.85	Light mjaela clay, Kelivaara.
28.3	2.68	1.92	Cambridge clay, Kivimiemi.
29.2	2.77	1.96	Cambridge clay, Kiviniemi.
			Soil section.
67.8	2.27	0.73	Mo rich in humus A - bed } Karis.
53.3	2.57	1.20	» » B - bed } Karis.
22.9	2.71	2.09	Marshland, marl (bituminous soil) upper bed } Zurich.
25.8	2.67	1.98	middle bed } Zurich.
29.0	2.68	1.90	Marl under bituminous soil (subsoil) »

Pore space	Specific weight	Volume weight	SAMPLES
			Minerals and Stones.
		1.24	Anthracite.
		1.88	Schungite (Schunga) - Olonetz.
		1.92	Graphite Schungite from Suojaervi - Finland.
		2.09	Graphite (earth) from Krumau - Bohemia.
		2.46	» (crystal) » Maentyharju - Finland.
	2.65	2.65	= Quartz.
	2.60	2.60	= »
	2.44	2.44	= Trindinite (somewhat impure, graphitic.)
	2.42	2.42	= Chrystobalite (somewhat impure, graphitic).
	2.19	2.20	Quartzglass.
		2.55	Feldspar from Kimito - Finland.
		3.15	Tourmaline from Tyrvea »
		4.10	Gadolinite from Kimito »
		2.57	Rapakivi granite from Aeland - Saltvik.
		2.68	» » Mariehamn.
		2.65	» » Kotka.
		2.64	» » Simola.
		2.69	Granite from Kalajoki.
		2.66	» » Iisalmi.
		2.65	» » Nystad.
		2.79	Diorite » Kaalamo.
		2.99	Diabase » Lavia.
		2.88	Gabbro » Kyvinkaeae.
		3.40	Amphibolite » Leppaevirta.
			Brick earth products.
36.8	2.96	1.87	Cambridge clay heated to 900° C.
24.0	2.66	2.02	» » » » 1000° »
12.5	2.55	2.33	» » » » 1100° »
9.3	2.57	2.33	» » » » 1150° »
30.1	2.65	1.85	» » clinkers
11.2	2.58	2.30	» » »
23.9	2.55	1.94	Builders' bricks, postglacial clay (Aminne) heated to 900° C.
21.3	2.62	2.06	Quartz-clay bricks from Sweden
25.4	2.44	1.82	Quartz-lime bricks from Sweden.
28.5	2.56	1.83	"Stella" bricks.
22.4	2.41	1.87	Quartz-limestone 10 from Germany.
20.0	2.39	1.91	» 12 »
26.1	2.49	1.85	» 22 » Finland
40.2	2.69	1.57	» 30 » »

B. FROSTERUS and H. FRAUENFELDER.

HYDROGEN-PEROXIDE CATALASE OF MARSH SOILS.

The influence of the soil as a positive catalytic agent in the combination of hydrogen with oxygen at an ordinary temperature was already known by THEO. DE SAUSSURE (1), LIEBIG and H. IMMENDORF. The last named ascribed this interesting property to the microorganisms of the soil. A. J. NABOKISCH, LEBEDEFF (3), KASERER and others further investigated this question.

The converse phenomenon, that the soil liberated molecular oxygen from hydrogen-peroxide was known to BERZELIUS (4), FRASS and SCHOENBEIN (5), and in recent times was investigated by J. KOENIG (6), C. KOPPENRATH, HASEN-BAEUMER and PAPA KALANTARIAN (7). In this respect the soil resembles certain catalytic agents, such as the fine dust (of almost colloidal fineness) of some metals: gold, silver, platinum; many oxides (8), manganese dioxide, manganese tetroxide, ferric-oxide, super-oxides, sesquioxides, the ultra-violet rays and some enzymes (9).

KOENIG considers the hydrogen-peroxide catalase of the soil (he finds it absent after liberating molecular oxygen from H_2O_2) to be a very important property (10) of the soil, and ascribes it in the first place to the enzymes in the micro-organisms and vegetable matter, for he found that this property of the soil diminished after partial sterilisation by heating, chloroform (11) or carbon disulphide. Like COPPENRATH and HASENBEAUMER, he explains this by its close connection with the humus content. MAY and GILLE held the same opinion (13). Many investigators consider it of very great importance in estimating the properties of the soil (14), others, for instance D. CHOUCHATK (15), measure the biological index by it. KOENIG gives numerous instances of catalytic action before and after soil sterilisation, and from his discoveries it is evident that inorganic matter also plays an important part and that it is a question not only of soil catalytic action (16) by bacteria or the residues of organic matter. This is found to be the case also as regards marsh soils.

In spite of the fact that the origin of this soil catalase cannot be attributed strictly to the characteristic properties of the soil only, it will not be without interest from a purely soil science point of view, to compare the catalytic capacity of some marsh soils and

endeavour to ascertain some relations, or at least tendencies among them. It will be shown how in a large number of soil types the hydrogen-peroxide catalase in vertical sections alters, and how it is changed by drying the soil at different temperatures. Types of different texture and, where possible, from different climates will be considered. An attempt will be made to find a connection between this soil catalase and the physical structure, hygroscopicity and constant and variable soil reaction.

The degree of soil catalase was measured eudiometrically. As the decomposition of the hydrogen peroxide of most of the catalases also depends on the H_2O_2 concentration and the reaction temperature, the working conditions were in every case identical and constant. Five gms. of fine earth were treated, 20 cc. of H_2O_2 were added and the temperature kept at exactly 17° C. The first determinations of liberated oxygen were made without reduction of atmospheric pressure, the second were ascertained after such reduction (the second result is therefore much smaller than the first).

Types were examined, the majority of which in the ZEMEDELSKY Archives (17) showed that they were related in physical composition. Here, for the sake of brevity, their physical composition will not be discussed, but only their pedological classification (according to KOPECKY), and for a more complete soil determination is added the hygroscopicity according to RODEWALD-KITSCHNERLICH (18) and the calcium carbonate content estimated approximately with the Kreidl volumetric apparatus.

As may be seen from Table I, the soil substance varies very much in composition.

The oxygen set free by the treatment of air-dried soils (under conditions given above) is shown in Table II, column *a*.

(TABLE I, *see page 107*).

TABLE I.

Origin	Depth in cm.	Soil type	Hygroscopicity	Ca CO_3	pH reaction constant	pH reaction variable
		I. — AGRICULTURAL SOILS.				
1. Hulin	10–20	humous loam — dark brown . .	5.28	0.1	7.3	7.0
»	30–40	" " " " . .	5.98	0	7.1	7.0
»	60–70	" " " " . .	5.75	0	7.1	7.0
»	90–100	" " " " . .	6.25	0	7.0	7.0
»	120–130	Yellow Loess loam	3.19	0	7.3	7.0
»	300–310	" " "	—	9.64	7.3	7.2
2. Břest-Hulin.	10–20	sandy loam — brown	4.40	0.3	7.3	7.2
»	20–30	" " — dark brown. . .	4.49	0.4	7.3	7.2
»	40–50	slightly clayish sand — yellow .	1.63	0	—	7.2
3. Slapanice 84	20–30	clay loam — brown	6.87	0	7.2	7.0
»	40–50	clay loamy soil — brown . . .	7.74	0.1	7.2	7.2
»	60–70	yellow loess loam	5.45	19.6	7.2	7.2
»	120–130	" " "	5.07	17.0	7.2	7.3
»	140–150	" " "	—	32.7	7.2	7.3
4. Slapanice 85	10–20	clay loam — brown	7.08	0.2	—	—
»	40–50	clay loamy soil — brown . . .	8,18	0	—	—
»	80–90	yellow loess loam	6.77	0.2	—	—
»	130–140	" " "	—	12.0	—	—
5. Ivanovice.	10–30	humous clay loam — dark brown	6.18	0	7.2	7.2
»	44–60	clay loam — yellow	6.56	0.5	7.2	7.2
»	60–75	loam — yellow	5.22	10	7.3	7.3
»	80–90	" "	4.88	14.7	7.3	7.3
6. Hrušovany-Sanov . .	20–30	humous, sandy, clay loam — black	8.58	0.3	7.3	7.2
» . .	90–100	clay loam — greenish	11.62	19.4	7.2	7.2
Hrabitice.	10–20	loamy sand — brown	2.38	0.1	7.1	70
7. Hustopeč.	5–15	loam — brown	5.53	11.6	7.3	7.3
«	20–30	" — grey	6.08	6.5	7.3	7.3
»	35–45	" "	4.94	26.9	7.3	7.2
»	80–90	fine sandy loam — yellow . . .	3.89	18.4	7.2	7.3
8. Olomouc	20–30	sandy loam — brownish — yellow	3.06	0	7.1	7.0
»	50–60	loamy sand	1.10	0	7.0	6.5
» Upper Ortstein	60–65	slightly clayish sand — reddish.	1.65	0	6.5	6.5

TABLE I (*continued*).

Origin	Dept in cm.	Soil type	Hygroscopicity	Ca CO_3	pH [illegible] constant	pH [illegible] variable
8. Olomouc Lower Ortstein	75–80	slightly clayish sand — strong reddish	1.86	0	6.3	6.5
9. Hodonin	10–20	slightly clayish sand — dark brown	1.01	0	7.1	7.0
»	35–45	slightly clayish sand — brown.	0.61	0	7.1	7.0
»	80–90	slightly clayish sand — yellow. .	0.48	0	7.0	5.0
»	250	clay loam — greenish	6.66	3.2	7.2	7.1
10. Hrušovany	10–20	clay sand — black	3.91	0.3	7.3	7.2
»	30–40	clay loamy sand — brown . . .	5.73	0	7.2	7.1
»	60–80	clay loamy sand — brown-yellow	5.24	0	7.1	7.0
»	150–160	clay loamy sand — yellow . . .	1.62	6.1	7.3	7.2
11. Poštorná	10–20	sandy loam — brown	3.06	0	7.1	7.0
»	30–40	" " "	3.94	0	7.1	7.0
»	60–70	loamy sand — yellow-brown . .	2.88	0	7.1	7.0
»	150–160	slightly clayish sand — yellow .	1.50	0	7.3	7.0
12. Val Mezerici	10–20	slightly humous clay loamy sand — yellow	3.14	0	6.4	6.4
»	30–40	sandy loam — yellow	2.61	0	6.5	6.3
»	60–70	yellow loam.	5.95	0	6.5	6.3
»	120–130	loam — yellow	5.85	0	6.4	4.9
13. Radomin	8–13	" "	3.81	0	7.1	6.4
»	30–40	" "	4.26	0	6.4	4.6
»	80–90	loamy sand — yellow	4.51	0	6.4	4.4
14. Tichà	5–15	loam — grey	5.07	0	6.6	6.4
»	20–30	loam — yellowish	5.43	0	6.6	6.3
»	70–80	fine sandy loam — yellow . .	9.67	0	6.3	4.4
»	150–160	clay loamy soil — yellow .	8.55	0	6.3	4.4
		II — FOREST SOILS				
15. Adamov	0–3	forest litter	10.72	0	5.9	5.4
»	3–17	clay loam soil — light yellowish	4.28	0	6.3	4.5
»	17–34	" " " — nearly white .	3.67	0	6.9	6.1
»	34–49	" " " — yellow . . .	6.01	0	7.1	6.3
»	49–74	" " " — bright reddish	8.1[illegible]	0	7.1	6.3

TABLE II.

Origin	Depth in cm.	a Air-dried soil		b dried at 55° C.		c dried at 100° C.		d boiled in water for 1 minute	
		Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.
I. — AGRICULTURAL SOILS.									
1. Hulìn	10–20	10	57.2	5 10	38 58,2	5 10	27.2 43.4	5 10	29.6 50.5
»	30–40	10	52.4	5 10	33.5 56.6	5 10	27 42.6	5 10	27 49,2
»	60–70	10	36.4	5 10	24 39	5 10	19.8 31.3	5 10	20.7 36.4
»	90–100	10	20	5 10	14.4 22	5 10	12.2 18	5 10	9.2 16.3
»	120–130	10	25.6	5 10	18.8 28.5	5 10	15 23.8	5 10	8.6 18.8
»	300–310	6'50"	80	5	80	5 5'40"	73.2 80	5 5'4"	75 85
2. Brešt-Hulìn	10–20	5 10	26.4 40	5 10	24 39	5 10	22 35.6	5 10	19.8 34.3
»	20–30	5 10	28.2 41.8	5 10	25.2 39.6	5 10	21.6 35.4	5 10	16 31.7
»	40–50	5 6	70 80	5 6'33"	63.6 80	5 7'6"	60.4 80	5 7'45"	56 85
3. Slapanice 84	20–30	5 5'55"	72.3 80	5 6'4"	71 80	5 6'17"	69.8 80	5 7'40"	60.8 85
»	40–50	5 6	68.6 80	5 5'5"	79.6 80	5 5'22"	75.4 80	5 5'25"	79 85
»	60–70	5 10	46 79.2	5 8'25"	51.4 80	5 8'45"	50.8 80	5 8'8"	54 85
»	120–130	5 7'55"	61 80	5 7'15"	61.8 80	5 7'22"	61.2 80	5 8'23"	52.8 85
»	140–150	5 10	22 35	5 10	23.4 38.4	5 10	20.4 34.6	— —	— —
4. Slapanice 85	10–20	4'10"	80	2'53"	80	3'53"	80	5' 5'6"	84 85
»	40–50	5 9'10"	53.8 80	5 8'47"	53 80	5 10	45.2 76.4	5 10	43.2 76.2
»	80–90	5 10	43 68.2	5 10	40 69.8	5 10	39.8 68.3	5 10	33.2 61.2
»	130–140	5 10	48.6 77	5 9'35"	48.4 80	5 10	45.5 78.4	5 10	35.4 65.6
5. Ivanovice	10–30	5 7'12"	63.4 80	5 7'26"	60.2 80	5 8'19"	56 80	5 10	35.2 74
»	44–60	5 9	55.2 30	5 8'58"	53 80	5 9'35"	50 80	5 10	37.8 71
»	60–75	5 10	46.4 79	5 9'13"	51.6 80	5 8'50"	51.6 80	5 10	46.6 81.8

TABLE II (*continued*).

Origin	Depth in cm.	*a* Air-dried soil		*b* dried at 50° C.		*c* dried at 100° C.		*d* boiled in water for 1 minute	
		Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.
5. Ivanovice	80–	5 10	47.2 75	5 9′28″	48.6 80	5 9′25″	49 80	5 10	35.4 69
6. Hrušovany-Sanov . .	20–30	5 7′50″	66 80	5 5,12″	78.3 80	5 7	67.6 80	5 7′13″	66.8 85
» . .	90–100	5 10	15.4 23.6	5 10	13 22.8	5 10	13.6 22.4	5 10	4.6 11.4
Hrabetice	10–20	5 10	23.4 31.8	5 10	21.4 30.3	5 10	17.2 23.2	5 10	12 20
7. Hustopeč.	5–15	5 5′5″	79 80	4′15″ —	— 80	5 5′30″	75.4 80	5 8′58″	75 85
»	20–30	3′50″	80	3′23″	80	5 5′3″	73.6 80	5 5′15″	82 85
»	35–45	5 10	47.6 72	5 10	46 74.8	5 10	41.2 68.8	5 10	33 63.6
»	80–90	5 10	43.6 71.5	5 10	47 78.2	5 10	43.4 73.6	5 10	31 59.2
8. Olomouc	20–30	5 10	17.8 23.8	5 10	12.5 17.7	5 10	6.6 11	5 10	6.6 11
»	50–60	5 10	6.6 7.0	5 10	4 3.8	5 10	2.4 1.8	5 10	0.4 1
» Upper Ortstein	60–65	5 7′30″	50.8 80	5 7′10″	62 80	5 8′2″	56 80	— —	— —
» Lower Ortstein	75–80	5 10	11.6 14.7	5 10	7.2 7.8	5 10	7.6 10	5 10	2.4 3.9
9. Hodonin	10–20	5 10	10 12	5 10	7.8 9.8	5 10	4.8 6.4	5 10	4.7 7
»	35–45	5 10	4.8 4.3	5 10	3 2.6	5 10	2.2 1	5 10	0.4 0
»	80–90	5 10	4.6 3.4	5 10	2.2 1	5 10	1.4 0.2	5 10	1.4 0.5
»	250–	5 10	32.5 54.8	5 10	30.2 54.8	5 10	34.4 57.8	5 10	18.8 39
10. Hrušovany	10–20	5 10	36.8 50.8	5 10	34.6 50	5 10	30.8 44	5 10	26 39
»	30–40	5 6′30″	67 80	5 6′22″	66.8 80	5 6′45″	62.6 80	5 10	27 54.5
»	70–80	5 9	54.4 80	5 8′22″	54 80	5 7′59″	56 80	5 10	49 72
»	150–160	5 10	42.8 68.2	5 10	46.8 75.6	5 9′20″	51 80	5 10	36 63.2
11. Postorná	10–20	5 10	21.2 30	5 10	19.5 [illegible]	5 10	17.2 25	5 10	12.2 20.0
»	30–40	5 10	20.4 29.2	5 10	[illegible] 23.2	5 10	16.3 26.2	5 10	[illegible] 17.8

TABLE II (*continued*).

Grigin	Depth in cm.	a Air-dried soil		b dried at 50° C.		c dried at 100° C.		d boiled in water for 1 minute	
		Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.	Time in Min.	O_2 in cc.
11. Postornà	60–70	5	12.2	5	8.8	5	6.2	5	3.7
		10	16	10	12.3	10	9.6	10	7.8
»	250–260	5	10.4	5	7.3	5	7.2	5	1
		10	12.4	10	8.3	10	8.8	10	2.2
12. Val Mezérici	10–20	5	28.6	5	22.2	5	18	5	18.7
		10	38.8	10	32.6	10	26.6	10	29.2
»	30–40	5	36.8	5	30.2	5	25.4	5	24
		10	50.8	10	43.4	10	36.9	10	38.8
»	60–70	5	33.0	5	32.4	5	23.8	5	22.3
		10	46.8	10	46.8	10	42	10	37
»	120–130	5	14	5	10.8	5	14.1	5	6
		10	20	10	16.7	10	20.5	10	12.4
13. Radomin	8–13	5	37	5	34.2	5	26	5	33
		10	52.2	10	51.8	10	37.8	10	49.4
»	30–40	5	2.5	5	3	5	1.2	5	0.8
		10	2.2	10	2.6	10	0.4	10	—
»	80–90	5	2.2	5	2.2	5	—	5	2.8
		10	1.0	10	1.2	10	—	10	1.8
14. Tichà	5–15	5	44.6	5	43.6	5	35.2	5	31
		10	69.8	10	65.6	10	53.3	10	53.6
»	20–30	5	25	5	20.8	5	18.6	5	15.2
		10	36.2	10	32.5	10	28.7	10	28
»	70–80	—	—	5	76.4	5	66	5 11″	56
		5	80	5′21″	80	6′35″	80	8′	85
»	150–160	5	22.3	5	22.8	5	18.5	5	6.4
		10	33.6	10	36	10	27.3	10	14.5
II. — FOREST SOILS.									
15. Adamov	0–3	5	52.4	5	47.4	5	20.4	5	35.6
		10	78.3	10	74.6	10	34.4	10	53
»	3–17	5	13.4	5	9	5	4.8	5	1
		10	17.6	10	12.8	10	7	10	3
»	17–34	5	20.4	5	16.2	5	13.6	5	4
		10	30.2	10	27	10	22	10	8.6
»	34–49	5	47.8	5	44	5	38	5	34
		10	71.6	10	70.4	10	60.6	10	60
»	49–74	5	47.4	5	48	5	38.2	5	34.2
		10	72.2	10	72.8	10	59.6	10	58.2

The soils cannot be compared by the speed constant of FAITELOWITZ (19) because no suitable H_2O_2 concentration was found for the soil, in which there was molecular reaction (determined in milk and blood. High concentrations render the catalase inactive in both). For this reason the soils are compared according to the number of cc. of oxygen set free in equal time.

Between the quantity of the liberated oxygen and the hygroscopicity of the different soils there was no marked connection (20). In Brest-Hulín, for instance, the least hygroscopicity was found in the lowest layers, but they set free the greatest quantity of oxygen. At Tichà, the hygroscopicity, owing to the clay soil and iron, increases with the depth, the catalase also reached its maximum at a depth of 70 to 80 cm., on the other hand the upper layers come after the soil vegetable matter as regards catalase. In the Adamover forest zone the minimum hygroscopicity is at a depth of 17-34 cm. and increases regularly on either side, the maximum being at a lower level. The minimum catalase is in the leached layer below the forest litter. The dynamic force of the soil constituents appears to be in relation with the catalase.

The iron and varying lime content in this Adamof type is given in Table III.

TABLE III.

Origin	Depth in cm.	Fe_2O_3 %	Liberated O_2 in cc. in 10′	mg. CaO in 100 gm Soil	pH reaction	
					variable	constant
Adamov . . .	0–3	1.947	78	176	5.4	5.9
» . . .	3–17	1.608	17	38	4.5	6.3
» . . .	17–34	2.114	30	82	6.1	6.9
» . . .	34–49	2.110	71	168	6.3	7.1
» . . .	49–74	3.362	72	290	6.3	7.1

As may be seen from Table III. the lime and iron content, the hygroscopicity and the variable and constant reactions are related to the catalytic force (lime was not found in the soil in the form of carbonate).

It is interesting to observe how the upper bed rock layer in

the Olomouc section, becoming softer, differs from the lower. The upper layer is strongly catalytic whereas the lower is only slightly catalytic. As regards hygroscopicity there is only a comparatively slight difference.

No close relation was found between the calcium carbonate and catalase. In Hulin, for instance, the greatest catalytic power is found at a depth of from 300-310 cm., and here also the greatest quantity of lime was found. In Slapanice No. 85 the greatest lime content is at a depth of from 130-140 cm., the catalytic power here, however, takes the third place. The minimum catalase was found at 80-90 cm., though this zone is nearly as rich in carbonate as the vegetable mould. Though there appears no definite relation between the calcium carbonate content and the catalase, yet a certain tendancy thereto can be observed here. The soils showing the greatest catalytic force (Hustopec, vegetable mould, subsoil No. 1, Slapanice 85 vegetable mould) are richer in lime than soil of the lowest catalytic force (Radomin UG1,2, Hodonin UG1,2) (This result agrees with von KOENIG's).

If the soil catalase is partly of bacterial origin, then there must be a certain correlation between soil catalase and soil reaction. The degree of the constant and variable reaction of the soils examined is given in Table I (30 gms. of soil were shaken for 1 hour in 100 cc. of water, or with KCL, and the pH filtrate determined by MICHAELIS' colorimetric method).

Though neither the degree of variable, nor that of constant reaction always corresponds with the catalytic force of the soil, yet we find that the soil with the highest catalase showed the highest constant (pH Hustopec A. UG 1., Slapanice 84 A.). On the other hand the soils with the lowest catalase (Radomin UG 1,2, Hodonin UG 1,2) showed less or very little pH. This rather marked tendency is also related to the calcium carbonate content.

A further test was made in order to discover how the hydrogen-peroxide catalase changes after partial sterilisation of the soil by heating (22). The soil was dried at 50° and 100° C. until constant weight was obtained. The catalytic force of the soil thus dried is as shown in Table II, columns *b*, *c*.

From this Table it is evident that in many types, when dried at 50° C., the catalytic force increases (Hulin, Slapanice 84 UG., Slapanice 85, somewhat also in the case of Radomin, Hrušovany-Šanov A., partially in that of Ivanovice and Hustopeč), while in other

types it fell. A small majority show a slight decrease in catalytic force.

The catalytic force decreased after the partial sterilisation of the soil at 100° C. Only a few exceptions were found in subsoils at a great depth.

Tests were also made to discover how this soil force changes on boiling (23). The soil was boiled in water for 1 minute, and immediately after cooling hydrogen peroxide was added. The coucentration wos such that a quantity of H_2O_2 equal to that used in the other tests was used in the treatment, so that the results could be compared. In this way the values given in Table II, column *d* were obtained.

Boiling generally, diminished the catalytic force of all soils. This sterilisation greatly resembles in its effect the of results dry heating at 100° C. If a comparison is made of the differences obtained by subtracting the volume of the liberated oxygen before and after sterilisation of the soil, the data in Table IV result.

From the Table IV it is evident that from partial sterilisation of soil by dry heat at 100° C, most of the upper layers, or those next to them, suffer (Hustopeč 35-45 and Poštorná 60-70 are exceptions). This is in harmony with the atmospheric pressure which similarly decreases in the sections. As other authors have already shown, no relation between the numbers of organisms can be expected, for different species have a different capacity for liberating molecular oxygen from the hydrogen peroxide (certain staphylococci and sarcinae exert the greatest influence).

If we observe the difference in catalytic force between air-dried and boiled soils, the proportions are similar to those already mentioned (Hustopeč 35-45, Tichà 150-160 and Hodonin 200, for instance, are exceptions).

Nostitz (24) thinks that the catalase at greater depths decreases like the soil fertility and the humus and nitrogen content.

How the soil catalase changes on heating to a dull, red heat may be seen from the following examples, Table V.

If these figures are compared with those in Table II, column *a*, a great decrease is found in the liberated oxygen. Comparatively the greatest catalytic force is retained after heating to a red heat, by those types having a higher lime content, namely Hulin at 300 cm. and Slapanice at 140 cm. This is probably due to the chemical and mineral composition of the soil components (25).

TABLE IV.

Origin	Depth in cm.	Difference in the amount of oxygen liberated from the soil before and after sterilisation			
		By drying at 100° C.		By boiling in water	
		after 5′	after 10′	after 5′	after 10′
I. — AGRICULTURAL SOILS.					
1. Hulin	10–20	—	13.8	—	6.7
»	30–40	—	9.8	—	3.2
»	60–70	—	5.1	—	0
»	90–100	—	2.0	—	3.7
»	120–130	—	1.8	—	6.8
»	300–310	—	—	—	—
2. Brešt-Hulin	10–20	4.4	4.4	6.6	5.7
»	20–30	6.6	6.4	22.0	10.1
»	40–50	9.6	—	—	—
3. Slapanice 84	20–30	2.5	—	11.5	—
»	40–50	—6.8	—	—10.4	—
»	60–70	—4.8	—	—8.0	—
»	120–130	—0.2	—	8.2	—
»	140–150	1.6	0.4	—	—
4. Slapanice 85	10–20	—	—	—	2.8
»	40–50	8.6	—	1.7	2.2
»	80–90	3.2	—0.1	—0.6	—0.8
»	130–140	3.1	—1.4	—	—
5. Ivanovice	10–30	7.4	—	28.2	—
»	44–60	5.2	—	17.4	—
»	60–75	—5.2	—	—0.2	—
»	80–	1.8	—	11.8	6.0
6. Hrušovany-Sanov	20–30	1.6	—	—0.8	—
»	90–100	1.8	1.2	10.8	12.2
Hrabetice	10–20	6.8	8.6	11.4	11.8
7. Huštopec	5–15	4.4	—	4.0	—
»	20–30	—	—	—	—
»	35–45	6.4	3.2	14.6	8.4
»	80–90	0.2	—2.1	12.6	12.3
8. Olomouc	20–30	10.6	12.8	10.6	12.8
»	50–60	4.2	5.2	6.2	6.0
» Upper Ortstein	60–65	3.8	—	—	—

TABLE IV (*continued*).

Origin	Depth in cm.	Difference in the amount of oxygen liberated from the soil before and after sterilisation			
		By drying at 100° C.		By boiling in water	
		after 5'	after 10'	after 5'	after 10'
8. Olomouc Lower Ortstein . .	75–80	4	4.7	9.2	10.8
9. Hodonin.	10–20	5.2	5.6	5.3	5
»	35–45	2.6	3.3	4.4	4.3
»	80–90	3.2	3.2	3.2	2.9
»	250–	—1.9	—3.0	13.7	15.8
10. Hrušovany.	10–20	6.3	6.8	10.8	11.8
»	30–40	4.4	—	49.0	—
»	70–80	—1.6	—	14.4	—
»	150–160	—8.2	—	6.8	5.0
11. Postornà.	10–20	4.0	5.0	9.2	10.2
»	30–40	4.1	3.6	11.7	12
»	60–70	6.0	6.4	8.5	8.2
»	250–260	3.2	3.6	9.4	10.2
12. Val Mezerici.	10–20	10.6	12.2	9.9	9.6
»	30–40	11.4	14.5	12.8	11.8
»	60–70	4.2	4.8	10.7	9.8
»	120–130	—0.1	—0.5	8	7.6
13. Radonin.	8–13	11	14.4	4	2.8
»	30–40	1.3	1.8	1.7	2.2
»	80–90	2.2	1	—0.6	—0.8
14. Tichà	5–15	9.4	16.5	13.6	16.2
»	20–30	6.4	7.5	9.8	3.2
»	70–30	—	—	—	—
»	150–160	4.3	6.3	18.4	19.1
II. — FOREST SOILS.					
15. Adamov.	0–3	32	43.9	16.8	25.3
»	3–17	8.6	10.6	12.4	14.6
»	17–34	6.8	8.2	16.4	21.6
»	34–49	9.8	11.0	13.8	11.5
»	49–74	9.2	12.6	13.2	14.0

TABLE V.

Origin	Depth in cm.	Time	O_2 in cc.
Hulin	10–20	5 10	3.3 3.2
»	30–40	5 10	2.5 1.4
»	300–310	5 10	28.8 48.2
Ticha	5–15	5 10	2.5 1.4
»	20–30	5 10	2.8 1.7
Slapanice 84	140–150	5 10	32.5 45.2

The extent of the action of oxygen liberation at temperatures of 17°, 37° and 60° C. may be illustrated by graphs (Fig. 57).

From the foregoing diagram it is seen that with an increase of temperature during the reaction the quantity of oxygen liberated is greater at the same H_2O_2 concentration (See Hulin 10-20 cm., Ticha 5-15 cm.).

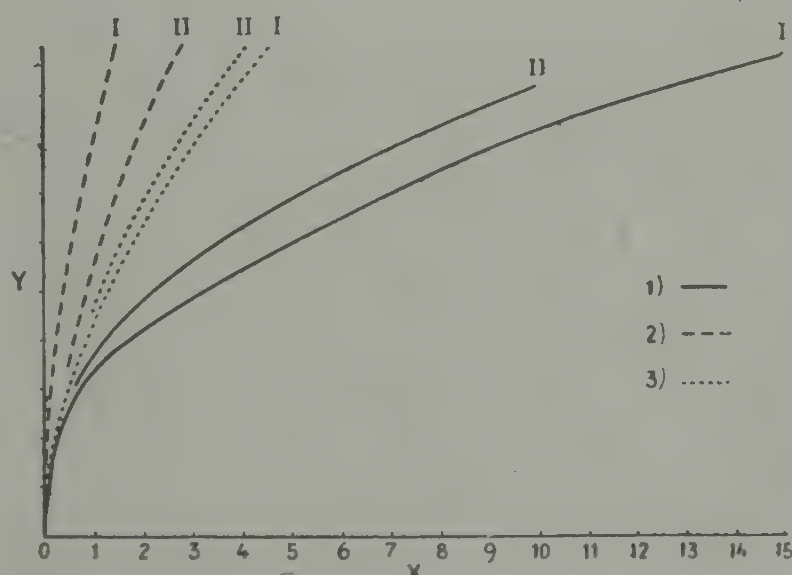

FIG. 57. — Intensity of oxygen liberation.
Y = cc. oxygen; X = Time in minutes

1) ——— at 17° C.
2) . . . . . at 37° C.
3) – – – – at 60° C.

I = Hulin mould at 10 cm.; II = Ticha mould at 5 cm.

How the quantity of oxygen liberated under the influence of

a different hydrogen-peroxide concentration varies, may be seen from the following diagram (Fig. 58).

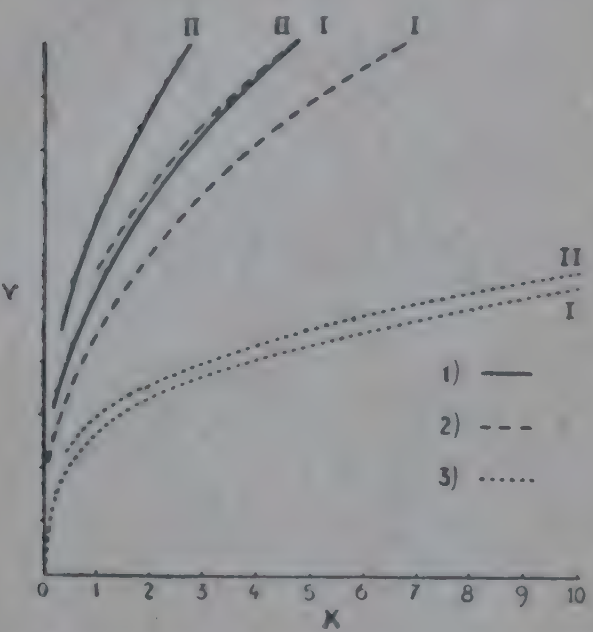

FIG. 58. — *Variation in the quantity of oxygen liberated under the influence of hydrogen-peroxide concentration.*

Y = cc. Oxygen ; X = Time in minutes

1) ——— 20 % H_2O_2

2) – – – – 10 % »

3) . . . . . 1 % »

I = Hulin vegetable mould at 10 cm. ; II = Ticha vegetable mould at 5 cm.

A higher concentration at the same temperature is accompanied by an increase in the quantity of oxygen liberated.

From all these results it is clear that the catalytic force of soils cannot be brought into close relation with any one of the characteristic soil properties mentioned. No general close connection was found between the physical composition, hygroscopicity, calcium carbonate content or degree of reaction, either constant or variable. This may perhaps be understood up to a certain point. If this property of the soil depends on the humus content, then it must be greatest in the vegetable mould and upper layers. As, however, it is influenced by various oxides (iron, manganese) in the subsoil it must increase with the depth. As lime also and a whole series of other elements in the soil come into play, it is clear that the hydrogen-peroxide catalase cannot be brought into correlation with any single property of the soil.

The concluding results obtained can therefore only be considered as certain tendencies, which become evident on studying the analysis data, and in no way as definite functions.

SUMMARY.

The object of this investigation was to determine the hydrogen-peroxide catalase in types of marsh soil, and to find out how it changes after partial sterilisation at a temperature of from 50°

100° C, after boiling, or finally, after heating to a red heat, and how various temperatures and H_2O_2 concentrations during the reaction show their influence, and to bring them into relation with:

(1) the physical composition;
(2) the hygroscopicity (27);
(3) the carbonate content;
(4) the constant and variable soil reaction.

The results of the investigation are as follows:

(1) In the subsoils treated, the hydrogen-peroxide catalase increased with the depth, as likewise the hygroscopicity and constant and variable pH concentration.

(2) The soils having the greatest catalytic force showed a higher constant pH and at the same time a higher calcium carbonate content. On the contrary, soils with the lowest catalase showed a lower constant pH reaction.

(3) After drying the soils at 50° C. the catalytic power altered irregularly. In some soils it increased, in others it diminished. After drying the soils at 100° C, also after boiling in water for a minute, the catalytic power of the great majority of the soils diminished. After heating the soils to a dull red heat the catalytic power diminished in all cases, but irregularly.

(4) With an increased H_2O_2 concentration the quantity of oxygen liberated also increased.

(5) With a higher temperature during the reaction the quantity of oxygen liberated also increased.

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(1) Wolf: Die chemischen Forschungen, 1847.
(2) *Landw. Jahrbuecher* 21, 1892.
(3) *Zentralblatt f. Bakteriologie.* II. Abt. 1906.
(4) Lehrbuch der Chemie, 1840.
(5) *Journal f. prakt. Chemie,* 1868.
(6) *Landw. Versuchsstat.,* 1907.
(7) Bakteriol. Untersuch. ue. Tschernozem-Diss., 1911.
(8) Koenig u. s. w. Landw. Versuchst., 1907.
Von L. Bohnson and A. C. Robertson: Die katalyt. Zersetzung von Wasserstoffsuperoxyd durch Ferrisalze. II. *Journ. Physic. Chem.* 25, 19, c. 1921.

(9) Cameron and Bell (Oxydasen) Woods (Peroxydasen) See under 8.

(10) Die Tschernosem-erden ragen durch eine ausserordentlich hohe katalytische Kraft hervor. Nach Papa Kalantarinian (1 g Erde + 400 cc 3 % H_2O_2 ergeben nach 30" z. B. 455 cc O. See under 7, 8, 11.

(11) Papa Kalantarian fuerth an, dass Chloroform sehr ungleich auf verschiedene Boeden wirkte. Bei einigen Boeden setzte es die katalytische Kraft nur sehr undeutlich herab, bei manchen erhoehte sie sogar diese.

(12) Versuche eine Beziehung zwischen der chemischen Zusammenstzung des Humus und der katalytischen Kraft des Bodens zu finden. See Smolík, IVth Soil Science Congress, Rome, 1924.

(13) The catalase of soils, *Porto Rico Agric. Exp. Station Circular* 9, 1909.

(14) H. Grossmann, *Landw. Versuchstat.*, 1908.

(15) *Comptes rendus hebd. d. séances d. l'acad. des sciences*, p. 1842. 1924.

(16) Gertrud Woker (1914) haelt die Peroxydase, Katalase, und die Reduktase fuer Enzyme von Aldehydcharakter. Ihr wiederspricht A. Bach (1924) der verschiedene Enzyme (auch Katalase) herstellte, aber die Eigenschaften von Aldehyden nicht vorfand.

(17) Smolík, Ueber Menge und Charakter der Matière noire in den maehrischen Boeden, 1924.

(18) Bodenkunde III.

(19) *Milchwirtschaftliches Zentralblatt*, 1910.

(20) Einige Veraenderungen der Katalase des Bodens bei Veraenderungen der gesammten Bodenoberflaeche sind angefuehrt: in Smolík, Beitrag zu den dyskolloiden Veraenderungen des Bodens, Zemedel. Archiv, 1924.

(21) Es handelt sich hier um ein saures Profil. Der Austauschkalk wurde bestimmt durch Extraction mit n-KCl.

(22) Papa Kalantarian vollzog die Sterilisation bei 2 Atm. Ueberdruck bei einer Temperatur von 133°, um nicht nur die Bakterien sondern auch die Enzyme zu vernichten. See No. 7.

(23) Siehe unter 15.

(24) *Landw. Jahrbuecher* 47, 1914.

(25) Interessant ist, dass die Schwarzerden — nach Papa Kalantarian — durch Gluehen annarhernd gleich leiden. Der Autor meint, dass man daraus auf eine annarhernd gleiche mineralogische Zusammensetzung der Schwarzerden schliessen koenne.

(26) Die Angaben von cc Sauerstoff sind nicht reduziert auf Atmosphaerendruk.

(27) H koagulieren die Bodenkolloide. Nach Aarnio kann man daher eine Beziehung zwischen den H" im Boden und der Hygroskopicitaet suchen. Bei dem Adamover Profil sehen wir tatsaechlich, dass in den Untergruenden, wo die aktuelle Aciditaet am geringsten ist (pH am groessten) die Hygroscopicitaet steigt.

THE HELP OF GRAPHS IN KOPECKY'S SCALE FOR SOIL CLASSIFICATION BY MECHANICAL ANALYSIS.

The soil cleansing apparatus of Prof. KOPECKY, as experience shows, is now increasing in importance, especially amongst agricultural scientists. Its success is naturally greatly enhanced by its easy manipulation, automatic working and the short time occupied by the analyses. This apparatus has been largely introduced into the Chechoslovakian Republic and used also in connection with maps, with excellent results.

As further experience shows, however, the examination of the character of the soil type by the process of mechanical analysis, for which investigation a special classification scale was drawn up by Prof. KOPECKY (1), is often attended with certain difficulties. Especially in mechanical analyses and in laboratory work at the Technical High School, the analyst students have always had to search in the scale in order to get together the right description according to the analytical data. This led me to draw up a simple scheme (graph), by means of which the description of the soil type desired could immediately be ascertained.

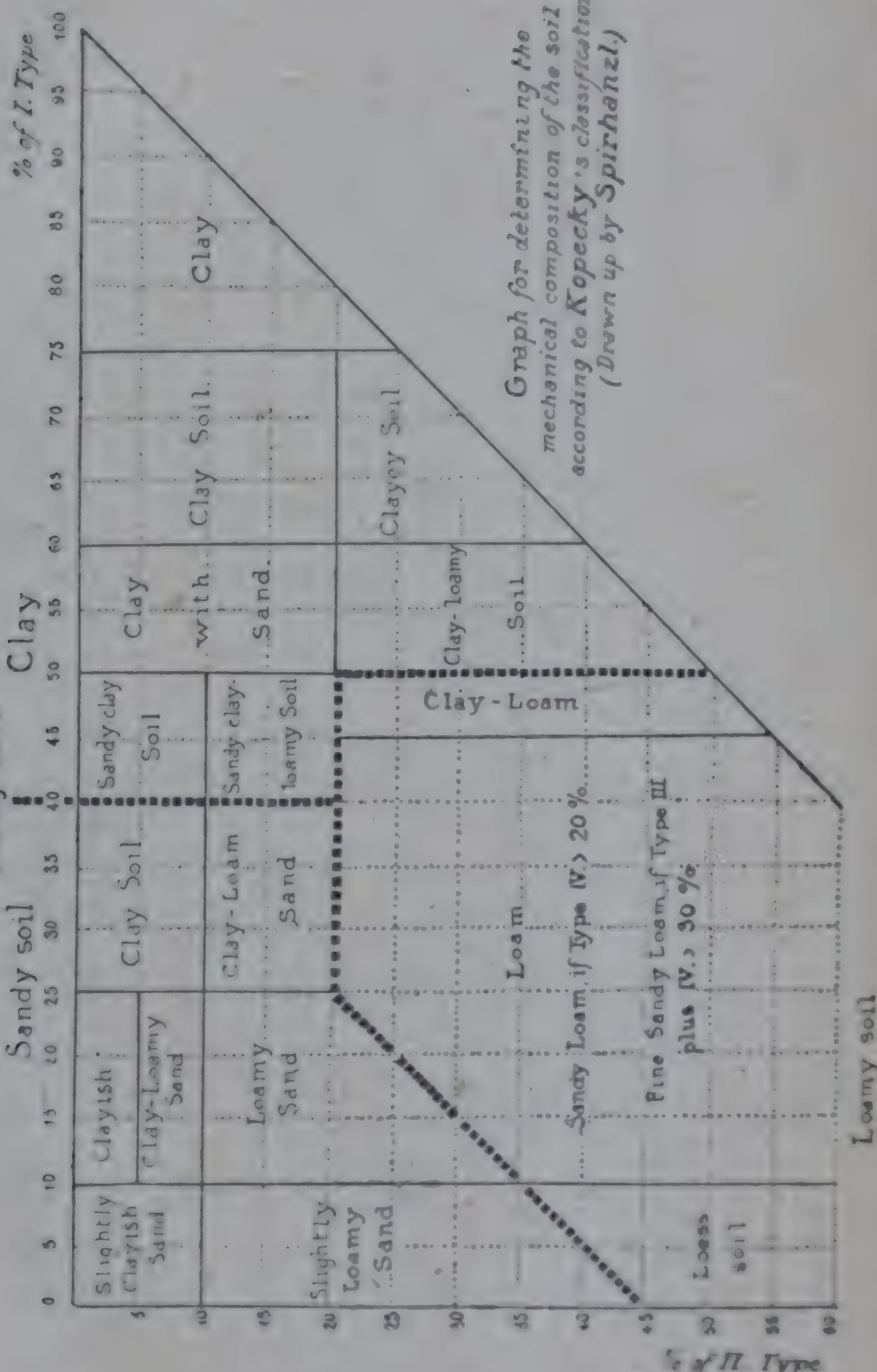
This plan is based on Prof. KOPECKY's classification scale, which takes into consideration chiefly two kinds of particles, viz., I. particles with a diameter of less than 0.01 mm. (the finest particles which may be held in suspension) and II. particles with diameter of from 0.01-0.05. In the diagram the data for the percentage content of particles of category I. in the soil type are shown in the vertical figures and the similar percentages of particles of category II. are shown in the horizontal figures.

If, therefore, following the analysis data, the corresponding figures of category I. be found in one column and those of category II. in the other, *the intersection of these lines shows the description as per classification* of the soil type under examination. For instance:

I. 55 %, II. 35 % . . . "Clay-loamy Soil"
I. 8 %, II. 35 % . . . "Slightly Loamy Sand" etc.

As, in the scale, for the outside space I. 0-10 %, and II. over 45 %, no allowance has been made, we have supplied Prof. KOPECKY's deficiency by inserting the corresponding "Loess Soil".

(1) "*Soil Type Classification*" - Prague, 1913, part. 22.



Graph for determining the mechanical composition of the soil according to Kopecky's classification scale (Drawn up by Spirhanzl.)

On the plan, the gradual change from sand to clay may very easily be followed. In addition, the individual character of the separate soil types, through their position in the common space is brought out very clearly, and a reference to the neighbouring group will also allow of the properties of each group being determined, and further, from the position of the point of contact in the single group space, by reference to the neighbouring spaces the properties of the soil type can be determined. If, for instance, the point of contact I. 20 % and II. 27 % lies near the " Loamy Sand " group, it is clear that the analysed loam will be very sandy,. . . and so on. Also, in the plan, the chief groups, Sand, Loam and Clay Soils, are enclosed by thick lines.

The simplicity of application of this diagram has been so far appreciated that it is already in general use for practical soil science at the Technical High Schools in Bohemia and the work of the students is thereby considerably lightened.

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THE INFLUENCE OF NEUTRAL SALTS ON SOIL REACTION.

It has long been known that neutral salts modify soil acidity. At first these modifications were measured by titration, but recently KAPPEN (5, 9), among others, has investigated the removal of the actual acidity by the addition of salts.

As very few systematic determinations of the reaction of different salts and soils had been made with this object, the author began these investigations some years ago. After the first series of tests had been made, it became evident that the colorimetric method did not give sufficiently exact results. The investigations therefore had to be made by the electrometric method *, but were delayed by the fact that the author hitherto had no suitable instruments at his disposal.

For the proposed tests, an acid and an alkaline loam soil, a sandy soil and an undecomposed sphagnum peat were used.

* The pH determinations were kindly made by Miss S. HEINZE.

TABLE I

Concentrations	KCl pH	KCl ac	KNO_3 pH	KNO_3 ac.	K_2SO_4 pH	K_2SO_4 ac.	NaCl pH	NaCl ac.	$NaNO_3$ pH	$NaNO_3$ ac.	Na_2SO_4 pH	Na_2SO_4 ac.
Alka[illegible]												
0	7.93	0.00	7.92	0.000	7.92	0.00	—	—	—	—	7.92	0.000
0,00003	7.92	0	7.98	0	7.90	0.0	7.90	0	7.94	0	7.92	0
0,0001	7.92	0	7.92	0	7.90	0	7.90	0	7.94	0	7.92	0
0,0003	7.87	0.01	7.92	0	7.90	0	7.85	0.015	7.94	0	7.92	0
0.001	7.82	0.02	7.79	0.05	7.83	0.02	7.85	0.015	7.87	0.01	7.86	0.01
0.003	7.68	0.06	7.92	—	7.75	0.04	7.80	0.03	7.87	0.01	7.90	0
0.01	7.54	0.09	7.53	0.095	7.64	0.07	7.75	0.04	7.75	0.04	7.79	0.03
0.03	7.30	0.21	7.40	1.055	7.45	0.13	7.68	0.06	7.67	0.06	7.75	0.04
0.1	7.28	0.22	7.31	0.205	7.39	0.16	7.58	0.08	7.56	0.085	7.71	0.05
0.3	7.29	0.22	7.30	0.21	7.39	0.16	7.50	0.10	7.50	0.10	7.68	0.06
1.0	7.29	0.22	7.30	0.21	7.84	0.02	7.45	0.13	7.46	0.135	7.65	0.065
1	7.22	0.25	7.25	0.235	—	—	6.81	0.41	6.10	0.92	7.79	0.04
Acid												
0,00000	5.05	0.00	—	—	—	—	—	—	—	—	5.05	0.000
0,00003	5.05	0	—	—	5.05	0	—	—	—	—	5.05	0
0,0001	5.06	0	5.06	0	—	—	—	—	—	—	5.10	0.01
0,0003	5.06	0	0.06	0	5.05	0	—	—	—	—	5.05	0
0,001	4.86	0.04	4.86	0.04	4.93	0.03	5.06	0	5.06	0	4.96	0.03
0,003	4.64	0.10	3.58	0.12	4.76	0.07	4.90	0.03	5.00	0.01	4.92	0.03
0.01	4.47	0.10	4.45	0.16	4.56	0.13	4.77	0.06	4.77	0.06	4.85	0.04
0.03	4.20	0.25	4.25	0.23	4.40	0.17	4.61	0.11	4.58	0.12	4.77	0.07
0.1	4.10	0.31	4.10	0.31	4.32	0.19	4.47	0.11	4.50	0.14	4.65	0.10
0.3	4.05	0.34	4.05	0.35	4.30	0.22	4.29	0.22	4.25	0.22	4.53	0.13
1.0	3.90	0.43	3.90	0.43	4.42	0.16	4.11	0.30	4.09	0.30	4.75	0.07
1	3.90	0.43	3.90	0.43	—	—	3.79	0.48	3.92	0.41	4.75	0.07
0,00000	5.13	0.00	—	—	—	—	5.13	0.000	—	—	—	—
0,00003	5.07	0.01	5.15	0	5.15	0	5.14	0	5.12	0	5.12	0
0,0001	5.10	0.01	5.10	0.01	5.15	0	5.14	0	5.12	0	5.12	0
0,0003	5.07	0.01	5.05	0.01	5.15	0	5.16	0	5.14	0	5.12	0
0,001	4.99	0.01	4.99	0.01	5.04	0.01	5.14	0	5.10	0.01	5.10	0.01
0,003	4.90	0.04	4.96	0.02	4.94	0.03	5.00	0.01	5.00	0.01	5.04	0.01
0,01	4.74	0.06	4.70	0.07	4.80	0.05	4.90	0.04	4.91	0.04	4.96	0.02
0.03	4.57	0.08	4.57	0.08	4.70	0.07	4.77	0.06	4.85	0.04	4.90	0.04
0.1	4.41	0.11	4.41	0.11	4.59	0.08	4.65	0.07	4.65	0.07	4.82	0.05
0.3	4.30	0.13	4.32	0.13	4.42	0.08	4.64	0.10	4.49	0.10	4.72	0.06
1.0	4.26	0.14	4.26	0.14	4.74	0.06	4.27	0.14	4.31	0.13	5.00	0.01
1	4.16	0.16	4.22	0.15	—	—	4.20	0.15	4.11	0.16	5.20	0.01
0	5.23	0.00	—	—	—	—	—	—	—	—	—	—
0,00003	—	—	—	—	—	—	—	—	5.26	—	—	—
0,0001	—	—	5.26	0.000	—	—	—	—	5.26	0.000	—	—
0,0003	5.26	0.00	5.26	0.000	—	—	—	—	5.26	0.000	5.26	0.000
0.001	5.25	0.00	5.25	0.000	5.26	0.000	—	—	5.26	0.000	[illegible]	[illegible]
0.003	5.26	0.00	5.20	0.18	5.30	0	5.26	0.000	5.26	0	[illegible]	0.18
0.01	5.19	0.21	5.19	0.21	5.30	0	5.16	0.14	5.26	0	[illegible]	0.18
0.03	5.16	0.24	5.18	0.22	5.26	0	5.10	[illegible]	5.21	0.17	[illegible]	0.18
0.1	5.10	0.31	5.10	0.31	5.26	0	5.04	[illegible]	5.15	0.15	[illegible]	[illegible]
0.3	5.07	0.34	5.08	0.32	5.16	0.24	4.94	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1.0	5.00	0.41	5.00	0.41	5.35	0.20	4.84	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	4.81	0.70	4.98	0.44	—	—	4.93	1.05	[illegible]	0.66	[illegible]	[illegible]

TABLE I.

H_4NO_3		$(NH_4)_2SO_4$		$CaCl_2$		$CaNO_3$		$MgCl_2$		$MgSO_4$		$FeCl_3$	
	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.	pH	ac.
2	0	—	—	7.92	0	—	—	7.94	0	—	—	7.92	0
0	0	7.90	0	7.90	0	7.90	0	7.92	0	7.90	0	7.92	0
0	0	7.90	0	7.85	0.015	7.90	0	7.92	0	7.90	0	7.84	0.015
1	0.03	7.90	0	7.81	0.03	7.85	0.01	7.84	0.015	7.90	0	7.84	0.015
5	0.04	7.85	0.015	7.73	0.05	7.76	0.03	7.80	0.03	7.80	0.03	7.50	0.10
8	0.06	7.70	0.05	7.65	0.06	7.64	0.07	7.69	0.06	7.60	0.08	7.19	0.26
0	0.10	7.60	0.08	7.38	0.07	7.40	0.16	7.52	0.09	7.50	0.10	5.00	1.08
9	0.16	7.50	0.10	7.20	0.26	7.24	0.24	7.35	0.18	7.41	0.15	2.98	—
5	0.23	7.35	0.18	7.00	0.37	7.00	0.37	7.25	0.24	7.34	0.19	—	—
8	0.28	7.35	0.18	6.83	0.44	6.87	0.44	7.20	0.26	7.30	0.21	—	—
7	0.33	7.27	0.23	6.58	0.65	6.20	0.84	7.04	0.35	7.24	0.26	—	—
4	0.60	6.73	0.55	6.10	0.93	—	—	6.10	0.93	6.54	0.68	—	—
—	—	—	—	5.05	0	—	—	5.05	0	—	—	5.05	0
5	0	5.05	0	5.05	0	5.05	0	5.05	0	—	—	5.05	0
5	0	5.05	0	4.96	0.02	5.05	0	5.05	0	—	—	4.98	0.01
5	0	5.05	0	5.00	0.015	5.10	0.01	5.05	0	—	—	4.86	0.05
0	0.04	5.00	0.01	4.78	0.06	4.81	0.03	5.05	0	5.00	0.01	4.67	0.08
5	0.07	4.75	0.07	4.59	0.11	4.56	0.13	4.77	0.06	4.82	0.05	3.98	0.09
5	0.13	4.64	0.10	4.46	0.15	4.47	0.15	4.57	0.13	4.65	0.09	2.98	1.10
5	0.19	4.46	0.13	4.28	0.21	4.28	0.21	4.47	0.15	4.54	0.13	—	—
0	0.31	4.36	0.19	4.10	0.31	4.14	0.28	4.31	0.20	4.45	0.16	—	—
4	0.35	4.36	0.19	4.04	0.35	4.04	0.35	4.14	0.29	4.37	0.19	—	—
6	0.40	4.46	0.15	3.90	0.43	3.96	0.40	3.97	0.39	4.28	0.21	—	—
6	0.43	4.29	0.21	3.06	0.55	3.58	0.60	3.46	0.69	4.09	0.31	—	—
—	—	—	—	5.15	0	—	—	5.15	0	—	—	—	—
10	0	5.12	0	5.15	0	5.15	0	5.15	0	5.15	0	5.05	0.01
7	0.01	5.10	0	5.15	0	5.15	0	5.15	0	5.15	0	5.15	0
7	0.01	5.04	0.01	5.09	0	5.09	0	5.09	0	5.10	0	4.98	0.02
7	0.01	4.96	0.92	4.93	0.03	4.90	0.03	4.98	0.02	4.98	0.2	4.50	0.10
0	0.04	4.90	0.04	4.72	0.06	4.53	0.06	4.81	0.05	4.85	0.05	3.67	0.30
4	0.06	4.70	0.06	4.53	0.09	4.53	0.09	4.65	0.07	4.70	0.07	2.84	0.69
1	0.08	4.61	0.08	4.33	0.13	4.33	0.13	4.48	0.10	4.58	0.08	—	—
5	0.10	4.57	0.08	4.17	0.15	4.19	0.15	4.33	0.13	4.46	0.10	—	—
0	0.13	4.50	0.09	4.09	0.17	4.07	0.17	4.17	0.16	4.40	0.11	—	—
6	0.16	4.57	0.08	3.93	0.20	3.93	0.20	4.10	0.17	4.36	0 12	—	—
9	0.19	4.36	0.12	3.70	0.29	3.70	0.29	3.57	0.34	3.58	0.20	—	—
—	—	—	—	5.26	0	—	—	—	—	—	—	5.26	0
—	—	—	—	—	—	—	—	—	—	—	—	5.30	0.10
—	—	—	—	5.26	0	—	—	—	—	—	—	5.26	0
—	—	—	—	5.26	0	5.26	0	—	—	—	—	5.26	0
—	—	5.26	0	5.26	0	5.25	0	5.26	0	—	—	5.16	0.24
6	0	5.20	0.18	5.16	0.25	5.22	0.10	5.21	0.18	5.21	0.10	5.16	0.24
8	0.31	5.14	0.27	5.07	0.33	5.07	0.33	5.08	0.31	5.14	0.27	4.74	0.89
8	0.31	5.14	0.27	4.99	0.43	5.00	0.40	4.97	0.47	5.05	0.36	4.18	—
8	0.44	5.12	0.29	4.77	0.83	4.80	0.77	4.81	0.75	4.92	0.58	2.87	—
36	0.65	5.05	0.33	4.55	1.24	4.55	1.24	4.68	1.00	4.81	0.74	—	—
4	0.70	5.05	0.33	4.31	1.64	4.37	1.55	4.44	1.43	4.72	0.92	—	—
6	0.78	4.83	0.71	3.77	—	3.90	—	3.78	—	4.33	1.60	—	—

The tests were made in the following manner. 10 gm. of dried soil were mixed with 100 cc. of salt solution. The following concentrations were used: 0; 0.00003; 0.0001; 0.0003; 0.001; 0.003; 0.01; 0.03; 0.1; 0.3; 1.0; in addition, a still higher degree of concentration was used, being, for the various salts, as follows:

KCl	KNO_3	$NaCl$	$NaNO_3$	Na_2SO_4	NH_4Cl
3.00	2.16	5.40	5.53	1.71	4.94
NH_4NO_3	$(NH_4)_2SO_4$	$CaCl_2$	$Ca(NO_3)_2$		
5.07	5.19	3.47	5.53		
$MgCl_2$	$MgSO_4$				
5.08	4.15-n				

The samples were shaken by hand several times, and allowed to stand over night in closed vessels and the next day the determinations were made by the quinhydronelectrode (BIILMANN, 4) on the soil deposits.

The results of these determinations are given in Table I (sse page 124-125).

(In these Tables "concentration" means concentration of salts solution, "pH", hydrogen concentration).

As the acidity modifications through titration were also of interest, the titration curves of the different soils were determined.

TABLE II.

Titration of the different soils.

		1	2	4	6	8	[illegible]
cc. of Acid . . .	0	2	4	6	8	10	
Alkali Loam.	7.92	7.50	7.35	6.90	[illegible]	[illegible]	[illegible]
Acid »	5.05	4.64	4.30	3.95	[illegible]	[illegible]	[illegible]
Sandy Soil.	5.16	4.48	3.94	3.43	[illegible]	2.71	[illegible]
Peat	5.26	5.22	5.20	5.00	[illegible]	[illegible]	[illegible]

10 gms. of dry soil were mixed with various quantities of sulphuric acid and then diluted to 100 cc.

As however in this investigation only the question of acidification was dealt with, only the acid sections of the titration curves

were determined (1). From the curves thus obtained (Fig. 59), the quantity of liberated acid was estimated by a graph. These values are shown in the Table I under « ac. ».

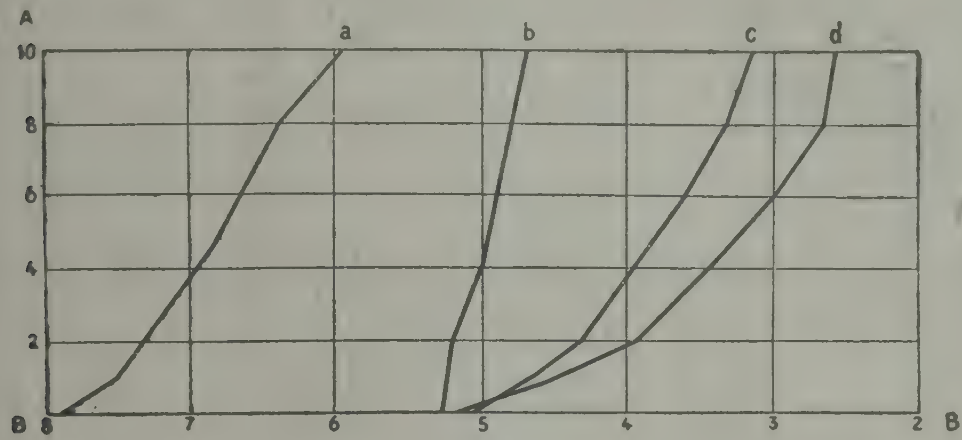

FIG. 59. — Acid set free.

A = H_2SO_4 per gm. of dry soil; B = pH.; *a* = alkaline loam.; *b* = peat soil; *c* = acid loam; *d* = sand.

The origin of the acidification is usually attributed to the so-called potential acidity (7). This might be represented by the following equation:

$$HBd + CaCl_2 = HCl + CaBd$$

provided the salt added be $CaCl_2$ and the acid soil substance, Bd. Through the formation of salts there should be an increase of acidity. The acidity however does not depend on the quantity of acid available, but on the H-ion concentration. But this does not vary according to the equation. FREUNDLICH (6) points out that it is very probable that, as stated by ROTHMUND, the basic variation may be explained by the formation of a strong solution, that is, the phenomenon may be defined as a separation of the salts present into two solvents. If this explanation is sound, it will be still more difficult to explain the potential acidity as a phenomenon of adsorption. If the potential acidity really existed, the phenomena could be estimated by the FREUNDLICH formula. As previously mentioned (3), however, the author has shown that this is not the case if the hydrogen-ion concentration be calculated on this formula, without taking into consideration the buffer-action of the soil.

It might be said that it is the quantity of acid formed, and not

the hydrogen-ion concentration, which depends on the concentration of the salt solution. Were the increase in acidity a variable phenomenon, the logarithmic values, represented by a graph, would form a straight line. From Figs. 60 and 61, however, it will be seen that this is not the case; the lines are curved, and this is also the case with DAIKUHARA's values (5).

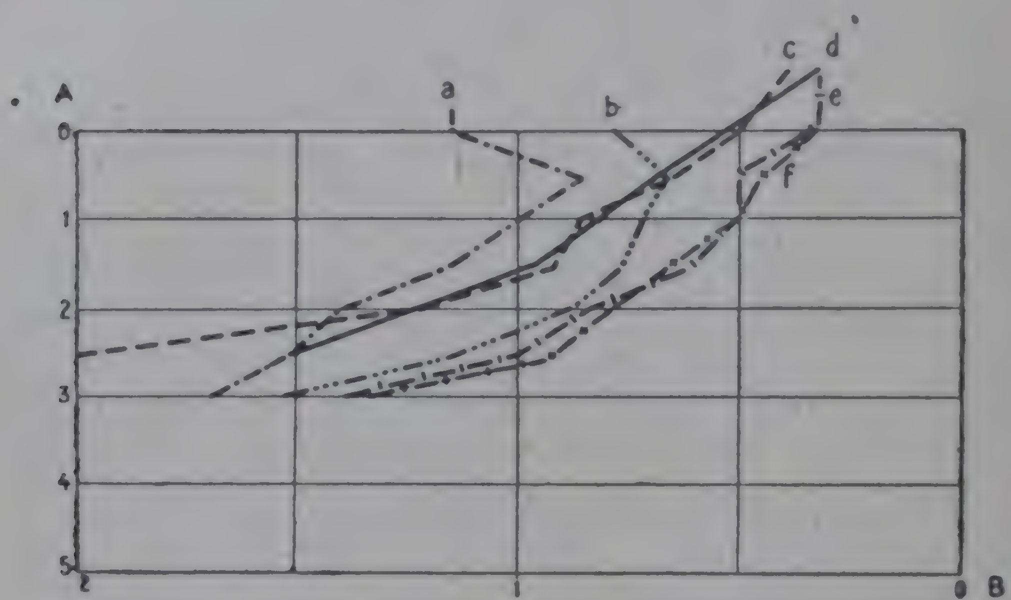

FIG. 60. — Hydrogen-ion and Salt Concentration in Acid Loam Soils.
A = Log. Concentration; B = Log. "Liberated" Acid.
a = Na_2SO_4; *b* = K_2SO_4; *c* = $NaNO_3$; *d* = NaCl; *e* = KCl; *f* = KNO_3.

Another arguement against the explanation of the phenomena as variable is that alkaline loam, also according to RAMANN an adsorbent saturated soil, in some cases, both in actual and titration acidity, has undergone greater changes than acid loam. In other instances the contrary is the case. There is therefore no rule that the adsorbent unsaturated soil can take up more cations from the salt solutions than the adsorbent saturated soil.

Hence it appears as though the definition of increased acidity as a variable phenomenon is not tenable. How then can the matter be explained? One way of explaining it is by assuming that neutral salts exert an influence. If a dilute acid solution be mixed with a stronger neutral salt solution it gives rise to an increased acidity. (In some cases also a decreased acidity may be the result.)

This is accounted for by the fact that the hydrogen-ions are

stimulated, or that the OH-ions are expelled, whereby an apparent increase in acidity takes place.

Exactly the same phenomenon takes place if quartz, permutit, cotton or similar substances be treated with neutral salt solutions. It would be very useful to explain the soil phenomenon from the same point of view.

From the Tables it will be seen that the chlorides exercise the greatest influence, and the nitrates come next ; the sulphates have

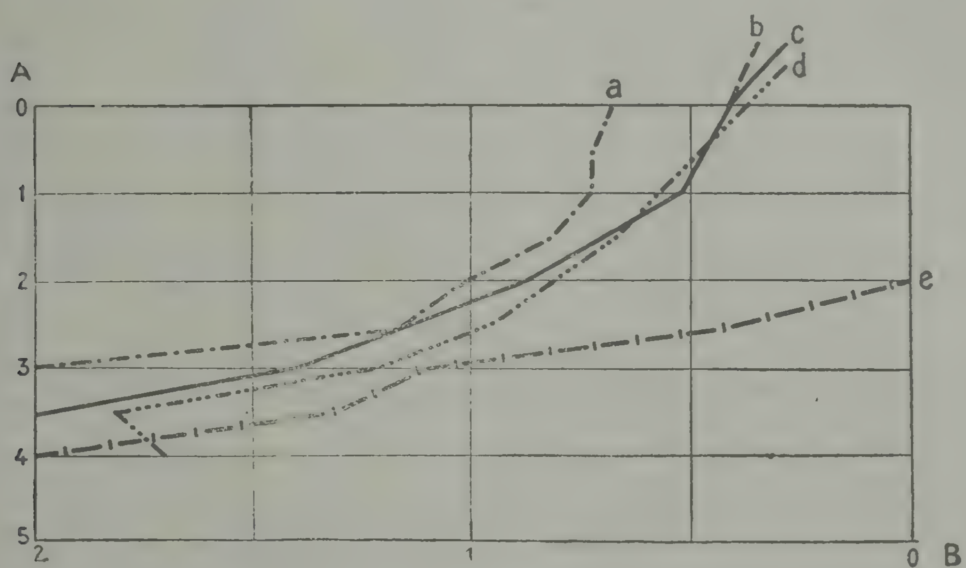

FIG. 61. — Hydrogen-ion and salt concentration in acid loam soils.
A = Log. concentration ; B = "Liberated" acid.
a = $(NH_4)_2\ SO_4$; *b* = $NH_4\ HO_3$; *c* = $NH_4\ Cl$; *d* = $Ca\ Cl_2$; *e* = $Fe\ Cl_2$.

the weakest influence. The same order will be found in ACKERLOEF's works (8).

Among the cations, Fe has the strongest influence, then come the Ca, Mg, K, NH_4 and Na series. These facts justify us in regarding the phenomenon as brought about under the influence of neutral salts.

The greater the buffer reaction of the substances treated, the stronger is the modification of their acidity.

By explaining the influence of the salt solutions in this way, the question of soil acidity will be simplified ; the same kind of acidity exists before and after the addition of the salts, there is therefore no new acidity, which moreover would be very difficult to define.

***

The extent to which soil acidity is affected by the addition of artificial fertilisers is of great interest as regards manuring. In certain cases even, mineral fertilising may be a failure, for it gives rise to too strong acidity, which, after the investigations on soil reactions made in recent years (2), may be easily understood.

Large quantities of manure are generally added to sugarbeets. In order to give a clear idea of this question, a summary of the frequency of various additions of potash and Chili nitrate made to the soil in an agricultural district in the south of Sweden are here given:

TABLE III.

Frequency of manuring to soil under sugarbeet.

Amount added	0	100	200	300	400	500	750 kg. ha.
40 % potash	221	109	234	24	18	—	2
Chili nitrate	27	26	163	205	165	8	4

Supposing an addition of 200 potash and 400 kg. Chili nitrate per ha. be made, this, assuming that the water content of the soil be 15 % and the weight of one ha. 3,000,000 kg., corresponds to a 0.0045 % of potash solution and a 0.009 % of nitrate solution. For pure salts (this has no practical application) the concentrations would be: a 0.0011-n NO_3 solution and a 0.0006-n KCl solution. From Table 1 it will be seen that these concentrations correspond to the following acidity modifications:

	$NaNO_3$	KCl
Alkaline Loam Soil	0.2	0.3
Acid " "	0	0.1
Sandy	0	0.1
Peat	0	0.1

As will be seen, the modifications are very slight after these additions of fertiliser. It must also be borne in mind that a very low water content has been allowed for here. But with the addition of 1000 kg. or more per ha. very considerable modifications may take place, as will easily be calculated from Table 1.

***

During the last decades a series of methods for determining soil acidity have been elaborated (see especially 1), in which the

determinations were made on soil precipitates or filtrates plus concentrated soil solutions. Chloride of potash especially has been used in these determinations. During the last few years, especially in Germany (9), the pH determinations have been made on KCl extracts instead of water, and indeed the KCl method is that principally used there. The author has made enquiries of several investigators as to the preference shown for the KCl method and has generally received the following answers:

1. By the KCl process a clear solution is obtained, but with water turbid extracts are often obtained.

2. By the addition of KCl the maximum results in the soil reaction changes caused by manuring are obtained.

3. By the KCl process constant pH values result.

4. From the values obtained with KCl, information may also be gathered as to the soil's need of lime.

5. By this process (according to KAPPEN, 7) much more important potential acidity is measured.

These points will now be examined:

1. Clearer and better solutions are certainly obtained by the addition of KCl. But the same also happens when acids are added. The objection to the last method for pH determinations is generally understood, but the addition of KCl has also an acidifying effect and should likewise therefore be rejected. What it is desired to ascertain through the pH determination is the actual acidity present in the soil, and this mostly for physiological purposes. By the addition of KCl this acidity is modified; therefore by the KCl method something quite different from that desired is measured. Unfortunately it is also impossible to transmute the values obtained with the KCl solution by means of a correcting factor into the "water values."

2. It has been shown that the salt concentrations in the soil obtained by rather abundant manuring are 1/1000 of those which are generally used in these methods (7 % or 1-n KCl). The maximum values, therefore, are never reached, nor even approached.

3. That the values obtained electrometrically after the addition of KCl are more constant than those obtained in soil suspensions in water, is erroneous. By the use of indicators errors with regards to the salts are greatly increased, and especially with methyl-red quite erroneous results are obtained.

4. That the "lime requirement" of the soil can be measured

by the addition of KCl solution seems very improbable. On the one hand we know that as regards soil reaction different plants have quite different tendencies, on the other hand, from tests made, it appears possible to mistake the quantity of lime necessary to convert a soil to a pH unity by determining the titration curve of the soil. If the pH values which are obtained from the three acid soils, are compared before and after the KCl treatment the following is found :

	pH before KCl	After treatment	Difference
Peat	5.25	4.84	0.41
Acid Loam . .	5.05	3.90	1.15
Sand.	5.13	4.16	0.97

According to this it must be concluded that the sand and loam soil have about the same need of lime and the peat much less. From the titration curve it will be seen however that the peat has a much greater lime requirement than the other soils, which is in accordance with the experience of farmers.

5) As shown above, it appears very improbable that potential acidity exists. But it has never been proved that this fact is of any physiological or physico-chemical importance. On the other hand it is clearly shown what a great influence soil reaction has on agriculture (2). It appears to be more important to establish an extremely weighty factor, than to turn one's attention to questions not yet clearly defined and, as it appears, wrongly explained.

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Neutral salt solutions exercise an acidifying influence. It appears as though this influence may be regarded as a neutral salt influence. Ordinary artificial fertilisers exert very little influence in the matter of modifying reactions, on the contrary large additions may even have an unfavourable effect on soil reaction.

Apparently the estimation of soil reactions in salt solutions is an unsatisfactory method.

O. Arrhenius, *Stockholm*.

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Abstracts and Literature.

The Aeration of Soils as Influenced by Barometric Pressure Changes.

BOUYOUCOS, G. J. and MCCOOL, M. M. (Michigan Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 1, pp. 53-63, figs. 7, Baltimore M., 1924.

In the investigation of this problem, the barographs were buried in the earth and the graphs thus obtained were compared with those obtained in the open air. It was found that at a depth of 10 feet the barometric pressure was the same as in the open air, this being the case in all soil types, including even heavy clay. It must be concluded therefore that the air in the soil has free communication with the outside air as far as the impermeable strata.

Calculations then showed that the greater the variations in pressure and the deeper the impermeable strata, the more extensive is the aeration of the soil and the deeper the penetration of the air therein. When on the other hand these factors are slight, the air penetrates to a lesser extent. Considering the whole earth, it must be concluded that the influence of barometric pressure on soil aeration is considerable, especially in the torrid zones; certainly this influence is greater than is generally supposed.

A. F.

Remarks and Observations on Imbibitional Soil Moisture.

FISHER E. A. *Journal of Agric. Science* 14, Part 2, 204-220, 1924

In previous papers (*Roy. Soc. Proc.* 103 A. 1923, pp. 139 and 164) the author has shown that the evaporation curves of water from wood, sand and kaolin, ball clay, etc., form four straight intersecting lines. The factors determining the shape of the curves depend on the vapour pressure of the water present, the temperature of the drying mass, capillarity and the diminution of the evaporating surface. The first portion of the rate curves can be expressed by the equation $-\frac{dw}{dt} - A = kw$, in which A and k are characteristic constants for each substance. Similar curves were obtained for a deep subsoil containing 55.4 % of clay, yet the section corresponding to the above-mentioned curve sections showed a considerable inclination, for the direction of which the author deduced the equation $-\frac{dw}{dt} - A + a\,(w - n) - \left|\frac{dw}{dt} - A\right| = kw$. In this equation A, a and k are constants and n the percentage water-content at which the curvature ceased. Curves of the second kind are found only in the case of evaporation curves of materials such as clay soils, which are mixtures of colloidal and non-colloidal substances, for water in colloidal combination evaporates at an approximately constant rate, while the rate of evaporation of the capillary "interstitional" water quickly decreases.

In this paper the manner in which the "imbibitional" water is retained by the soil colloids, as compared with the interstitional or capillary water, is contrasted.

If the critical moisture content, at which the evaporation speed ceases to be constant, be compared with the moisture equivalent determined by the BRIGGS and MCLANE method (*U. S. Dept. of Agric., Bur. of Soils, Bul.* 45, 1907), i. e. that in which the percentage of water in the soil, which remains after the elimination of the water from the capillaries by centrifuging, it will be found that in the absence of colloidal substances, as for instance quartz sand, the moisture equivalent is less than the critical moisture content (the contrary is the case with substances containing colloids). This can only be explained by the fact that the water retained by the clay, or organic matter, as well as by the coating of colloids on the particles of soil acts differently from the moisture retained in the capillaries. According to the tests by PROCTER and his collaborators (*Journal Americ. Chem. Soc.* 40, 886, 1918) the force which causes the entrance of water into a gelatine gel and thus determines the expansion, is the osmotic pressure of the excess of crystalloid-ions inside over that outside the gel; this excess is a consequence of the DONAN equilibrium (*Zeitschr. f. Elektrochem.* 17, 572, 1911). The opposing force, limiting expansion, is the cohesion of the colloidal particles. A gelatin gel expanding through the absorption of water acts as a perfectly elastic body and obeys HOOKE's law ($e = CV$ (V = vol. increase in cc. of 1 mgm equivalent weight gelatine, C = constant corresponding to the modulus of elasticity and e the osmotic force producing the expansion). In conformity with this law the author found, in his

investigations with a saturated wool fabric, which was centrifuged at various speeds, that the moisture content, i. e. the degree of expansion, is a linear function of the centrifugal force used. The tests made by other investigators, for instance those by BRIGGS and MCLANE on the moisture content of soils after centrifuging at a varying number of revolutions, also led to the same results. If xylol be used instead of water, the former causing no expansion of cotton, wool, soil, etc, much less xylol than water is retained after centrifuging. This also proved to be the case with soils, as will be shown by a comparison of the moisture and xylol equivalents in the following Table:

Moisture equivalents and xylol equivalents of various materials.

Material	Moisture equivalent (*ME*)		Xylol equivalent (*XE*)		*ME-XE*	Max. imbibitional water = 1·38 *ME*	Percentage imbibitional water retained after centrifuging
	Dry wt. basis (1)	Volume basis	Dry wt. basis	Volume basis (2)			
Kaolin	41.2 / 40.8 } 41	106.6	33.0	99.4	7.2	47.1	4.9
Ball clay. . . .	47.2 / 45.5 } 46.3	120.4	20.2	60.9	59.5	166.2	35.8
Silty soil. . . .	23.5 / 22.6 } 23.0	59.8	8.2	24.7	35.1	82.5	42.5
Clay subsoil . .	51.6 / 47.8 } 49.7	129.2	13.8	41.6	87.6	178.3	49.1

(1) Calculation on basis of real specific gravity of soil = 2.60.
(2) Calculation on basis of real specific gravity of soil = 2.60 and specific gravity of xylol = 0.863.

The differences between the moisture equivalents and the xylol equivalents probably furnish a standard for the imbibitional water absorbed by the colloids, as distinct from the interstitial liquid. In kaolin, possessing, as is known, but few or no colloidal properties the moisture and xylol equivalents, on a volume basis are almost the same. This indicates that water, like xylol, is retained interstitially, and that little or no water is held by imbibition. In the other three tests the imbibition and consequent expansion is considerable, and much greater with the clay subsoil than with the ball clay.

BERJU.

Capillary Distribution of Moisture in Soil Columns of small Cross Section.

MCLAUNGLIN, W. W. (Bureau of Public Roads). *United States Department of Agriculture. Department Bulletin* No. 1221, p. 22, Fig. 7. Washington, D. C., 1924.

The author carried out experiments for the purpose of ascertaining the distribution of capillary moisture in vertical, horizontal and inclined

soil columns. Different kind of soils were used, distributed evenly and uniformly into 32-38 mm. pipes. Capillary moisture did not decrease or increase in relation to proximity to the water level. The highest percentage of moisture was not found close to the water level, but at some distance from it. The chart recording the percentage of moisture present in the soil columns shows an irregular curve, the ends of which, corresponding to the top of the column, form almost a straight line.

In all the experiments carried out, except in a test on the silty sand of Idaho, the quantity of water found in the lower half of the pipes was greater than the average content of the entire soil column. A moderate content of water was present from the half of the soil to $^2/_3$ of its height while the greatest quantity existed at a height varying from $^1/_7$ to $^1/_8$ of the immersed portions of the column. In all the soil columns the same percentage of moisture existed at a distance of a few inches from the level of the water. The different methods of cultivating the soil and of aeration caused no alteration in the moisture content.

In the horizontal soil columns, with a vertical line of 100 m/m to the horizontal surface, it is observed that the highest degree of moisture is generally, though not necessarily, present at the further end of the pipe, in close proximity to the water. A moderate percentage exists at a distance from the water equal to half the length of the pipe ; its distribution alters when the water reaches the outer end. In columns that are inclined towards the base, the highest percentage is present at the top of the pipe when the force of gravity and capillarity act simultaneously. The total quantity of moisture contained is a good deal less than the capillary saturation. If the flow towards the base is stopped by an impervious layer, the content of moisture above this is equal to that observed in a vertical soil column with the water level at the surface of this layer.

A. F.

The Theory of the Mechanical Analysis of Sediments by means of the Automatic Balance.

FISHER R. A., and ODEN, Prof. SVEN. *Proceedings of the Royal Society of Edinburgh*, Vol. XLIV, Part 2, pp. 99-115. Edinburgh.

In 1916, in a paper on the size of the particles in deep-sea deposits, Odén showed that the distribution by mass of a suspension into classes of particles of different size, could be inferred from a study of the course of sedimentation of such a suspension from a state of uniform dispersion in water.

In the article now published, the authors have set forth, in a more complete form than has hitherto been attempted, the theory of the derivation of the distribution curve and the statistical methods appropriate for its deduction from the physical data.

A summary of the conclusions drawn is as follows :

(1) A simplified mathematical statement of the theory of sedimentation through a stationary fluid, leads to the formula indicated by Odén,

and shows that the characteristic distribution of the sediment may be obtained:

(*a*) from the variation of density with depth ;
(*b*) from the rate of change of density at a given depth ;
(*c*) from the variation of hydrostatic pressure with depth ;
(*d*) from the rate of change of hydrostatic pressure at a given depth.

The last relationship affords the theoretical basis of the sedimentation method.

(2) Schloesing's sedimentation is incomplete, and leads to errors.

(3) Statistical problems arise in the reduction of sedimentation data derived from the automatic balance, and data from two duplicate experiments are utilised to examine into the experimental errors actually present.

(4) Two types of fluid motion appear to influence results :

(*a*) A vertical circulation set up by the initial disturbance of the fluid. This may be remedied by using fluids of higher viscosity.

(*b*) Convection currents of unspecified type will become important in prolonged experiments, where the finer particles are being studied. Great experimental refinement may be necessary to avoid these ; their effect should be reduced by maintaining the temperature of the water as close as possible to its temperature of maximum density.

W. S. G.

Investigations on the Rate of Outflow of Granular Substances.

G. Schultz zur Oven. Untersuchungen über das Ausfliessen von Körnungen.

Langhans, in his investigations on the angle of inclination (*Kolloid Zeitschrift*, Vol. XXVIII, 3), found that each powder or granular substance has a characteristic angle of inclination, and recommends the determination of this angle for the identification of food-stuffs, powders, etc. According to Langhans the angle of inclination depends on the specific gravity, friction coefficient and size of grain of the substance. According to Boussinesq (*Beibl. z. d. Annalen*, Vol. 6, 1919), the flow of the sand through an hour-glass, with a suitable size of grain, depends on the form and dimensions of the vessel, not on the height of the sand itself. For a number of substances : kaoline, sand, loam, loess, chalk, clay, slate, corundum, glass, I have accurately tested the flow through suitable vessels, in order to determine the importance, as affecting the outflow of the particles, of the specific gravity, size of grain, form and nature of the surface of the particles, and the shape of the vessels. For the tables, illustrations, graphs and full text, see my Dissertation, Giessen, 1912.

The following is a summary of the results :

(1) The specific weight has no decisive influence on the outflow of dry particles.

(2) The speed of the outflow does not depend on the height of the material in the vessel.

(3) It is however dependent on the shape of the vessel, on the size of

the grain of the same material on the shape of the particles and the nature of their surface; for speed of the outflow of the different fractions of the same substance there is an optimum. AUTHOR.

A Note on Soil Shrinkage.

E. A. FISHER. *Journal of Agric. Science*, 14. 126-132, 1924.

A critical review of W. B. HAINE's theory on the progress of soil shrinkage after the drying of the soil (*Journal of Agric. Science* 13, 296). From the results of this investigation the importance of the critical water content, i. e. the water content at which rapid evaporation ceases to be constant, and the divergence between the lower part of the moisture curve and the corresponding part of the vapour pressure curve, can for the first time be accurately defined. BERJU.

Method for Determining the Permeability of Colloid-Dispersing Substances under the Influence of Electrolytes.

G. SCHULTZ ZUR OVEN. Methodisches zur Untersuchung der Durchlässigkeit Kolloiddisperser Substanzen unter der Einwirkung von Elektrolyten.

The apparatus used by HISSINK for determining the permeability of the soil under the influence of various salt solutions (*Int. Mitt. für Bodenkunde* Vol. 6, 1916) does not sufficiently prevent the escape of the colloid-dispersing particles. In the method used by the writer, both the utility of a porcelain filter and also that of Dr. HAEN's membrane filter were tested, and it was found that a certain type of membrane filter does not allow the dispersing particles to pass through, so that it is possible to work on a large scale with these "ultra" filters (1). Reference should here be made to a work by W. WENSE, the expert in filtration technique (*Zeitschrift für angewandte Chemie* 1923, No. 47-8, pt. 310), in which the difficulties and inconveniences often arising in the filtration of highly dispersive suspensions are mentioned, and effective measures of precaution and practical hints given.

The use of a high suction pressure increases the rate of filtration, but even then a slackening of speed very soon takes place. The use of tubes over the membrane gives but slight results and of short duration; the use of a broad, soft brush, with which from time to time the "obstructing layers" may be removed from the membrane, and perhaps also particles blocking the pores, proved to be more effective; but even then the advantage gained is not great. On the other hand, the cleaning of the pores by driving a current of air and water through them was quite effective. The advantage gained through the water current was, however, due to the increased volume of water passing over the membrane, partly negatived as regards the total duration of filtration. The greatest rate was attained by a regular alternation between filtration and air-current. The conven-

(1) More detailed information may be had from the writer's Dissertation (Giessen, 1924).

iently placed taps on the apparatus made possible very accurate and effective working.

The local conditions of soils are due to the varying dispersion of the soil colloids. Granulation, i. e., the formation of the larger soil particles is largely dependent on the nature of the electrolyte with which coagulation is effected. In suspensions of colloidal soil particles, as well as in Berlin-blue sol, the rate of filtration proved to be dependent on :

(1) The degree of dispersion. — With increasing sedimentation the speed decreased ; the hydrostatic level played a subordinate part in this connection.

(2) The electric chargeability of the dispersed particles. — It was important first to determine the chargeability of the dispersum before commencing the test, or, as is easily possible with Berlin blue, to produce a clearly defined electric material. The differences in the series of tests with positive and negative electric material are very great, as will be seen from the graphs and the sedimentation determinations made on the interruption of the experiment.

There are no essential differences between sol and gel as regards the influence of the electrolyte.

The variation in dispersion brought about in the sol does not cease in the gel, so that here it is a case of a merging of the series of phenomena into one another, it being assumed that the optimum of the structural change had not yet been reached in the sol.

A structural change in colloidal systems is adopted in agriculture when, for instance, it is necessary to lime a soil. Here the absence or presence of soil acidity, as tests with acid and neutral loess have shown, plays a prominent part. The degree of soil dispersion is heightened by potash ions, for calcium ions are supplanted by them and the soil cakes over. This interchange of bases is reversible.

(3) The influence of the electrolyte concentration. Until expansion takes place the size of the coagulated particles is largely dependent on the electrolytic concentration, but this influence appears to be of secondary importance.

(4) The nature of the electrolytes. Both cations and anions come into action during the coagulation ; the cations appear to have the greatest influence. The diminishing influence of the electrolytes on the dispersion phase is dependent on the chargeability of the dispersum and very particularly on the atomicity of the electrolytes. AUTHOR.

Investigations on Alkali Soil and Colloidal Phenomena.

JOFFE, J. S. and McLEAN, H. C. (New Jersey Experiment Station). *Soil Science*, Vol. XVII, No. 5, pp. 395-409, figs. 2. Baltimore, Md., 1924.

The work hitherto done on soil alkalis had a purely practical scope and and was based on empiricism. Only in recent times in Russia has a series of investigations to discover the origin of soil alkalis and reaction been begun. Such knowledge is necessary before undertaking any scientific treatment. An important feature of the recent investigations is the estimation

of the colloidal nature of some phenomena inherent in soil alkalis. The following conclusions may be drawn from the authors' investigations. The positive and negative absorption of the soil and soil solution system is of great importance for the washing out of the soluble substances. A negative absorption is desirable in alkaline soils. The coagulation of the colloids increases the surface tension of the extract and modifies the physical conditions of alkaline soils, which modifications show themselves by the capillary ascent of the water and the soil's permeability to water. In the investigations on the effects of alum and sulphuric acid on the coagulation of the alkali soil colloids, the authors have observed that the combined effect of both such substances is greater than that of either of them separately. At pH 4.7, coagulation is almost instantaneous, which indicates that this is probably the isoelectrical point. The alkaline soil colloids are charged negatively and then precipitated from the colloids with a positive charge, or by electrolytes with high-power cations. The dispersal phase which affects the surface, influences evaporation ; the vapour pressure of the extracts undergoes little alteration from the various treatments.

In normal soils, the colloids serve to retain various constituents and therefore delay washing out ; in alkaline soils, this colloidal property reduces the permeability and aeration of the soil and increases its power of retaining substances, thus bringing about the accumulation of the salts after dessication.

A. F.

Soil Climatic Conditions and Clay Silicates.

GANSSEN R. (Gans) (Die Klimatischen Bodenbedingungen der Tonerdesilikatgesteine). *Mitteilungen aus den Laboratorien der Preussischen Geologischen Landesanstalt* part 4, pp. 32. Berlin, 1922. (Published by the Preussischen Geologischen Landesanstalt, Berlin, No. 4, Invalidenstrasse 44).

In this work the author discusses the decomposition of clay silicates. Three kinds of weathering are described :

(1) the weathering of clay ;
(2) the weathering of laterite ;
(3) weathering by hydration.

The author describes in detail the methods for determining the various types of decomposition, and then discusses the chemical processes which take place in connection therewith.

(1) The weathering of clay in moist, cool and temperate zones :

$$\underbrace{z(6SiO_2 \cdot Al_2O_3 \cdot K_2O)}_{\text{(potash feldspar)}} + x H_2O = 4\underbrace{(6SiO_2 \cdot Al_2O_3 \cdot K_2O \cdot m H_2O)}_{\text{(zeolitic silicate)}} + \underbrace{2SiO_2 \cdot Al_2O_3 \cdot 2H_2O}_{\text{(kaolin silicate)}} + \underbrace{[illegible]}_{\text{(soluble potash [illegible] partly colloidal [illegible])}}$$

(2) The lateritic or clay-lateritic decomposition in semi-moist, torrid, and temperate zones :

(*a*) purely lateritic decompositions :

$$\underbrace{6\,SiO_2 . Al_2O_3\,K_2O}_{\text{(feldspar)}} + x\,H_2O = \text{(primary process)}\ \underbrace{6\,SiO_2 . Al_2O_3 . K_2O . m\,H_2O}_{\text{(zeolitic silicate)}} + y\,H_2O$$

$$= \text{(secondary process)}\ \underbrace{Al_2O_3 . 3\,H_2O}_{\text{(hydrargillite)}} - \underbrace{6\,SiO_2 . K_2O . n\,H_2O}_{\text{(soluble silicate, eliminated)}}$$

(*b*) clay lateritic decomposition :

$$\underset{\text{(feldspar)}}{6\,SiO_2 . Al_2O_3 . K_2O + x\,H_2O} = \left\{\begin{array}{c} \textit{primary process} \\ 4\text{-}6\,SiO_2 . Al_2O_3 . K_2O . n\,H_2O \\ \text{(zeolitic silicate)} \\ \\ + 2\,SiO_2 . Al_2O_3 . 2\,H_2O \\ \text{(kaolin silicate, unchanged by} \\ \text{further influence of water).} \end{array}\right. \begin{array}{c} \\ \longleftrightarrow \\ \\ + y\,H_2O = \\ \\ \longleftrightarrow \\ \\ \end{array} \left\{\begin{array}{l} \quad \textit{(secondary process)} \\ Al_2O_3 . 3H_2O \text{ (Hydrargillite)} \\ 4\text{-}6\,SiO_2 . K_2O . n\,H_2O \text{ (soluble} \\ \quad \text{silicates liberated).} \\ \\ + 2\,SiO_2 . Al_2O_3 . 2\,H_2O \text{ (kaolin} \\ \quad \text{silicate, unchanged in se-} \\ \quad \text{condary process).} \end{array}\right.$$

(3) Decomposition by hydration in arid and semi-arid zones :

$$\underbrace{6\,SiO_2 . Al_2O_3 . K_2O}_{\text{(feldspar)}} + x\,H_2O = \underbrace{6\,SiO_2 . Al_2O_3 . K_2O . n\,H_2O.}_{\text{(zeolitic silicate)}}$$

In addition to the factors of heat, precipitation and evaporation, the effect is discussed of the composition of the underlying rock on the type of decomposition, and the reaction of the resulting soil.

H. HALLER.

Soil Reaction in Relation to Calcium Adsorption.

SWANSON, C. O. (Kansas Agricultural College). *Journal of Agricultural Research*, Vol. XXVI, No. 3, pp. 83-123, figs. 7, tab. 23. Washington, D. C., 1923.

The author observes that acid soil reaction is not determined by organic substances. Indeed, the pH values are the same before and after soil burning ; further, a certain quantity of oxalic acid may be added to the soil without changing H-ion concentration. The addition of a slightly ionized acid, on the contrary, heightens CH-ion concentration, probably through the formation of salts of a weak acid with a strong base.

The cause of acid soil reaction should be looked for instead in chemical phenomena connected with the climatic factors which lead to soil formation. There is more probability of its acidity when the yearly rainfall is in excess of evaporation, whereas when the contrary is the case there is a tendancy to alkalinity. The cause of the acidity is to be looked for therefore in the carrying off of the bases, and especially of calcium, which takes place in the decomposition of the silicates. Under such conditions vegetation languishes since calcium is necessary to plant growth and development. The addition of calcium, in the form of Ca $(OH)_2$ to such soils tends to reestab-

lish the former conditions. In these processes it is a question of adsorption more than of chemical combination.

It may therefore be concluded that the presence of aluminium silicate brought about by the influence of climatic factors, causes the adsorption of the calcium of Ca $(OH)_2$ and $CaCO_3$. The washing out and treating with acids, which may be considered as an exaggeration of climatic factors, increases the soil's power of adsorption. The latter is therefore dependent on the aluminium silicates which are formed in such processes and may be considered as a phenomenon of base substitution. The adsorptive power of aluminium silicates is greater for calcium than potassium. A. F.

On the Measurement of the Hydrogen-ion Concentrations in Soil by means of the Quinhydrone Electrode.

BILLMANN EINAR. *Journal of Agricultural Science*, 14, 232-39, 1924 (Compare CHRISTENSEN and HARALD, *Intern. Mitteilungen für Bodenkunde*, 14, p. 2. 1924).

Hydrogen-ion Concentration in Soil and Lime Requirement.

JONES, J. S. (Oregon Experimental Station). *Soil Science*, Vol. XVIII, No. 1, pp. 65-74, bibliography. Baltimore, Md., 1924.

Crops are possible within certain limits of hydrogen-ion concentration, beyond which, however, the soil must be improved in order to bring it to the necessary concentration. Such investigations, however, though important, are generally neglected in the examination of soil. The author has made this determination on many soils, using the colorimetric method, which has given results in accord with the electrometric method, and has compared the values thus obtained with the lime requirement of soils.

Generally, if the hydrogen-ion concentration varies considerably in the same soil type, with the exception of two or three samples, which represent perhaps the extreme types, there is a remarkable uniformity in all the others. Alfalfa and clover crops may succeed well within rather wide limits of hydrogen-ion concentration. There is no relation therefore between this and lime requirement. A. F.

Investigations on Soil Minerals and their position in the Speier Stratum and Soils of the Kusel Beds as shown on the Geological Map (1 : 100,000).

(Untersuchungen ueber Böden Gesteine und ihre Lagerung im Blatt Speyer und Böden im Blatt Kusel der geologischen Karte 1 : 100 000). *Geognostische Jahreshefte* 35th Year, Munich, 1923.

In the previous Palatinate number of the Bavarian Geological and Agricultural Institute an important place is assigned to soil science investigations. OTTO M. REIS writes at length on the stratification and geological character of the various alluvial, loess, tertiary, coloured sandstone, shell-lime and lower red sandstone soils, while H. NIKLAS and A. HOCK treat of

the soil reaction and need of lime of the Speier beds. H. NIKLAS shows, from the results of investigations, that the soil reaction is more or less influenced by the geological structure, while OTTO M. NEIS is of opinion that soil acidity is not so much caused by the formation, the most important factor being the presence or absence of a forest growth, or the fact that it was a forest soil in a not distant past. Indeed, a soil becomes acid not in consequence of its petrological character, but through the influence of the plants which cover it, or the agricultural uses to which it has been put.

In comparing the different methods for testing soil reaction and its need of lime, many interesting facts come to light. Thus, as NIKLAS says, the need of lime does not depend on the existing quantity of lime, but on the buffer action of the soil, and what reaction it causes. The alluvial and loess-loam soils show the least hydrogen-ion concentration. Bunter sandstone and lower red sandstone, on the other hand, prove, in all the tests, to be acid. From the total acidity estimated by titration with $^1/_{10}$ N. alkaline soda solution, the quantity of lime necessary to neutralise the acidity was estimated, and thus the lime requirement of the field was determined. The titration of the soil acidity by DAIKUHARA's method gave no reliable values, for the iron and especially the aluminium hydroxide, formed colloidal compounds with the acid, which escaped titration. Neutral soils require a particularly searching test as regards their lime requirement. In CHRISTENSEN's azotobacter test, the five-days' treatment is decidedly preferable to the three-days' treatment, as was shown by the tests.

While the upper red sandstone soils in the Speier beds tested by NIKLAS are really all acid, there are, in the lower red sandstone of the Lautertal, between Olsbruecken and Wolfstein (Kusel beds), according to OTTO M. REIS, also alkaline soils near those which are acid. But the $CaCO_3$ content, determined by PASSON's method, was negative everywhere, and only once was a trace found of $CaCO_3$. In spite of this, the percentage of CaO content can be estimated at 0.41 %. These results show how carefully PASSON's lime test should be used. The only acid soil among the samples with 0.05 % CaO was taken from forest land.

Field crops, as is well-known, except on soil of the most marked lime formation, imply no surety against acidity, especially when physiologically acid artificial fertilisers are used.

HERM. FISCHER.

Importance of Hydrogen-ion Concentration in Physico-Chemical Studies of Hevea Soils.

BRADFIELD, R. (Agricultural Experiment Station, University of Missouri). *Soil Science*, Vol. XVII, No. 5, pp. 411-422, Fig. 6, bibliography. Baltimore, Md., 1924.

The author in this article discusses the flocculation of clay and the effect of hydrogen-ion concentration upon the absorption and exchange of bases. The importance of this in a physico-chemical study of soils is pointed out and its practical results.

A. F.

Changes in the Chemical Composition of Soils in Cylinders after long continued Treatment.

BLAIR, A. W. and PRINCE, A. L. (New Jersey Agricultural Experiment Station). *Soil Science*, Vol XVIII, No. 1, pp. 31-32, bibliography. Baltimore, Md., 1924.

The chemical composition of the soil continually changes, but our methods of investigation are not sufficiently delicate to follow such changes unless the determinations are made continuously over a long period of years.

The authors have investigated the problem with the cylinder method, already described in Bulletins Nos. 221 and 288 of the New Jersey Agricultural Experiment Station. The investigations covered a period of 25 years, various fertilising treatments being applied and both the soil and the crop analysed.

Phosphoric anhydride. — The quantity present in the soil, plus that carried away by the crop, is rather less than that generally present in the soil plus that added by fertilising. Supposing the fertiliser contains 100 lb. per acre, the loss is 13 lb. per acre. By doubling the addition of phosphoric anhydride, a larger crop is obtained, but the loss is three times greater. It must be concluded that the phosphoric anhydride is carried away by drainage water. When this fertiliser is applied in large quantities it may accumulate in the soil, which may be injurious.

Potash. There is generally a loss, notwithstanding applications of potash. Soils containing 2.6 % at the outset only contained 2 % at the end of the test. The loss was caused through the crops and the drainage water; the more abundant the fertilising in general, the greater is the loss under both these heads.

Lime. In the cylinders in which lime was not added, a decrease of the latter was observed; the loss was greater in that in which sulphate of ammonia only, without lime or farmyard manure, was used. With few exceptions, the cylinders in which lime was added showed an increase of the latter.

Magnesium. It was not applied as a fertiliser, but only added as a lime impurity and with farmyard manure. A decrease of from 2.24 % to 1.5 % was noticed.

Reaction. The soils in all the cylinders where lime was not added became acid. The lime requirement is reckoned at from 1400 to 2800 lbs. per acre; the pH value varied from 4.9 to 6.2 %. The cylinders in which lime had been added, on the other hand, showed no need of lime; their pH was from 6.5 to 7.3. The continued use of acid phosphates did not cause acidity.

Among the cylinders where lime had not been added, the greatest need of this was observed in that treated with sulphate of ammonia only; the soil became so toxic that not a single plant reached maturity.

A. F.

Comparison of the Soil Solution by Displacement Method and the Water Extract of Alkali Soils.

HIBBARD, P. L. (University of California, Agricultural Experiment Station). *Soil Science*, Vol. XVI, No. 6, pp. 465-471, bibliography. Baltimore, Md., 1923.

Two methods in use for the analysis of the soluble elements of soil are :— the " Solution ", obtained by the displacement method, and the " Extract ", obtained by mixing with the soil a quantity of distilled water almost entirely free from CO^2, equal to five times its weight, after which, the Pasteur filter is used. Experiments carried out by the author indicate that the water extract does not represent the actual conditions in the soil, as the figures recorded for carbonate, bicarbonate and phosphate are higher than those actually existing. The data registered for chlorine, sodium and nitrate are approximately correct ; sulphate and potassium show an excess, while the data given for calcium and magnesia may be either too high or too low. The geo-chemical classification shows that the water extracts contain a relatively higher proportion of sodium salts, whereas calcium and magnesium salts are less abundant than in the real solution. The latter makes the soil appear more suitable for the growth of plants than does the water extract method. A. F.

The Rapid Determination of Available Phosphate in Soil by the Coeruleo-Molybdate Reaction of Denigès.

ATKINS W. R. G. *Journal of Agric. Science* 14, Part 2, 192-197, 1924.

In determining the P_2O_5 in saturated soil extracts, 10 gm. of air-dried soil, which had been passed through a 100-mesh sieve, were shaken with 50 cc. of water, 10 cc. of the extract being centrifuged until clear, and 5 cc. of this extract was made up to 100 cc. and reduced by the following reagents : (Reagent A) 100 cc. 10% ammonium molybdate + 300 cc. 50 per cent by volume, H_2SO_4. (Reagent B) 0.1 gm. tin after the addition of one drop of a 4 % copper sulphate solution, was dissolved by 2 cc. pure HCl, and after solution of the Sn the whole was made up to 10 cc. For every 100 cc. of the extract prepared as above 2 cc. of reagent A, and 5 drops of reagent B (which must be freshly prepared every day) were added. With a similar quantity of these reagents a control solution was prepared containing 0.05 or in some cases 0.5 mg. of P_2O_5. After the addition of the reagents the solution assumed a blue colour, which attained its maximum intensity after 5 minutes. The colorimetric tests can be made in a simple manner in 100 cc. HEHNER cylinders. Faults through slightly coloured extracts, which impart a green colour to the blue solution, can be corrected by the addition of a few drops of a dilute solution of Bismark brown to the test solution. The method allows the P_2O_5 in the soil extract (1 : 5) to be determined even after considerable dilution. High phosphate contents were found in the samples taken from bog peats. In the majority of the soils examined, less than 2 parts of water-soluble P_2O_5 were contained in 1 million parts of soil. Manured soils contained

20 or more parts. A 3-4 hours' extraction gives the same P_2O_5 content in ordinary soils with a low P_2O_5 content, as a 4-7 days' extraction. In soils rich in P_2O_5 on the other hand, the solubility of the P_2O_5 appears to be retarded by lengthened extraction and may undergo reversion to an insoluble form during prolonged extraction.

BERJU.

The Determination of Nitrates in Soils.

HARPER, HORACE J. (University of Wisconsin, Madison, Wis.) *Industrial and Engineering Chemistry*. Vol. 16, No. 2, pp. 180-183. Washington, D. C.

Among the various methods proposed for the determination of nitrates in soils, that of phenoldisulphonic acid is most used because it is the simplest and quickest. It presents various difficulties however: (1) that of obtaining a perfectly clear and colourless extract, which is absolutely essential; (2) of obviating the losses in nitrate which occur, from various causes, during the determination; (3) of making an exact comparison between the sample solution, of known value, and the solution under examination, avoiding the use of reagents which interfere with the process.

In these notes the Author reports an accurate analytical process for obviating this difficulty, which ensures the most exact results being obtained. To obtain a perfectly clear and colourless extract, the Author, basing on practical tests repeatedly made on different types of soil, suggests as most suitable in all cases, the use of the sulphate and hydroxide of copper, which serve as excellent colorising and clarifying agents. The losses in nitrates during the determination process, as has already been observed by other experimentalists, chiefly takes place: (1) *through absorption* by certain decolorising and clarifying agents (e. g. the various kinds of decolorising carbons, aluminium hydroxide, etc.); (2) *through evaporation* when the extract obtained and which evaporates is acid; (3) through the presence of other salts in the extract, such as carbonates and chlorides, the latter only if found in the soil in quantities of more than 15 parts per million. To reduce to a minimum this loss in nitrates the Author proposes: to use copper hydroxide as a decoloriser, bring that portion of the extract which is to be evaporated to a distinctly alkaline reaction, and if necessary, set free the chlorides, precipitating with silver sulphate, and finally, when evaporation has taken place, add to the dry precipitate obtained 3 cc. of phenoldisulphonic acid in such a way that the whole of the precipitate, from the centre to the periphery, is completely saturated by the reacting agent. The presence of colorisations, which prevent an exact comparison being made between the nitrate solutions of known value serving as controls, and the solution under examination, is due either to the presence of organic substances or of insoluble salts in the precipitate, or to an irregular use of the various reacting agents.

By using copper hydroxide the colorisation due to organic substances is absolutely excluded. As to the other causes, to obviate them it suffices to follow out the process exactly.

L. M.

Iron, Aluminium and Manganese in Hawaiian Soils,

McGeorge, W. T. (Experiment Station, Hawaiian Sugar Planters' Association). *Soil Science* Vol. XVIII, No. 1, pp. 1-2, bibliography. Baltimore, Md., 1924.

Until now, the presence of free acids in soils has been considered the cause of their poor fertility. As a matter of fact, in the Hawaiian Islands, poor vitality in the roots of the sugar-cane and pineapple, the principal local products, has been met with in the highly acid soils. This however is associated with abundant quantities of soluble salts of iron and aluminium while on the other hand it has been found that the toxicity of certain acid soils must be attributed more to the presence of soluble salts of aluminium and manganese than to hydrogen-ion concentration. The principal characteristic of the Hawaiian soils, like many others of the acid type, is the absence of easily soluble salts of lime and magnesium and of soluble phosphates. Hence there is an accumulation of acid salts of iron, aluminium, manganese and of hydrogen-ions liberated by hydrolysis.

Soluble crystalloid salts of iron, manganese and aluminium were as a matter of fact found in soils with pH values below 5.8. With more than 6.0 pH, manganese is absent from the soil solutions, and iron and aluminium are only found therein as hydrosols of the hydrates of iron and aluminium.

The solubility of manganese as found by Comber's test, is due to the greater hydrogen-ion concentration, obtained by treating the soil with sulphocyanate of alcoholic potassium. The solution of normal nitrate of potassium does not liberate the aluminium from the silicates, except in soils with less than 6.0 pH. A. F.

The Electrical Conductivity of Extracts from Soils of various Types, and its Use in Detecting Infertility.

Atkins W. R. G. *Journal of Agric. Science* 14, Part 2, 198-203, 1924.

In determining the electrical conductivity of diluted soil extracts, 10 gm. of air-dried and sifted soil extract were diluted with 50 cc. of water, shaken and tested until there was no longer any appreciable alteration of the conductivity. In alkali soils, which showed the greatest conductivity, this took place after 6-14 days in soils with a slight salt content, and much sooner in peat soils, which showed a high conductivity. Acid soils generally showed but slight conductivity, which mostly reached its maximum after a short treatment.

Though a high salt concentration in the extract is no sure sign of soil fertility, it may however be concluded from the fertility data and the results of the tests, that the fertility is generally low in the case of such soils which exhibit very slight conductivity and show but little concentration of their liberated salts. On the other hand a high electrical conductivity of the soil extract may only indicate the presence of large quantities of liberated salts, and is not always necessarily a sure indication of the fertility of the soils in question. A rapid increase of conductivity in diluted extracts indicates on the other hand an increased liberation of salts, which

is partly effected by bacterial action and may therefore be taken as a useful criterion in judging fertility. Low conductivity, which after long-continued extraction persists, indicates that the soil is infertile.

BERJU.

Studies on Virgin and Depleted Soils.

MILLAR, C. E. (Wisconsin Agricultural Experiment Station) *Soil Science*, Vol. XVI, No. 6, pp. 432-448, bibliography. Baltimore, Md. 1923.

The greatest degree of solubility is found in virgin soils, as measured by the freezing-point method. Results of experiments continually proved this fact, which indicates that solubility gradually diminishes and forms an important factor in the transformation from virgin to depleted soils.

Generally speaking, solubility is apparent in lesser degree in the lower layers of soil than in those at the surface; it is also greater in the lower layers of depleted soil than in the same layers of virgin soil. This tends to show that the greater number of crop plants absorb nourishment from the surface or ploughed layers.

Cropped soils yield a greater quantity of sulphates, while virgin soils gave larger quantities of iron, aluminium, calcium and magnesium.

The proportion in which various constituent matters are given up by soils is an important factor in determining their crop producing capacity.

A. F.

The Soil Organic Matter and Accessory Substances promoting Plant Growth.

CLARK N. A. (Department of Chemistry, Iowa State College, Ames, Ia.), *Industrial and Engineering Chemistry*, Vol. 16, No. 3, pp. 249-250. Washington, D. C., 1924 (1).

The influence of soil organic matter on growth has been investigated from two points of view: its direct and its indirect influence.

Greater attention has been paid by the various investigators to its indirect influence. Its direct influence, which may be nutritive, toxic or accessory, is more difficult to investigate, but is very important.

The author cites, among those who have investigated the direct influence of soil organic matter on plants, the names of SCHREINER and SHOREY, who in 1910-1912 carried out systematic investigations and isolated a certain number of compositions in a pure state. Some of these compositions, as for instance picolin carbosilic acid, had a decidedly toxic effect on corn, when added to a nutritive solution. Others, such as histidin, were beneficial, and some had no influence.

KNUDSON and CORNELL proved that sugar can be assimilated by maize and legumes and LIVINGSTON pointed out the efficacy of small quantities of organic substance, added to nutritive solutions, on the growth of maize.

The possibility of some soil organic substances influencing the growth

(1) See also *R.* 1924, No. 596. (*Ed.*)

of green plants has been especially laid stress on by BOTTOMLEY in England. He even went so far as to admit that the addition of small quantities of organic substances, extracted from the soil, to the mineral nutritive element is absolutely essential to the life and reproduction of green plants. He gave the name of "auximones" to these accessory substances, and considered them analogous to vitamines.

The author continues by observing that it now seems an established fact that small quantities of organic substances influence the growth of green plants, but there are still doubts as to the nature of this influence. The question should be considered from two points of view: (1) these accessory substances are analogous to vitamines; (2) these accessory substances only accelerate growth.

The first point has been thoroughly investigated in the author's laboratory. It had to be proved whether green plants can or cannot live and reproduce themselves in the absence of these substances. The tests were especially made on *Lemna major* and *Lemna minor*, acquatic plants already examined by BOTTOMLEY.

Tests were made with various nutritive solutions. In DETMER and KNOP's saline solution, without the addition of any organic matter, these plants live with difficulty, whereas on adding a small quantity of organic matter they show vigorous development and normal reproduction. The mineral salts contained in the solutions were evidently not suitable for the plants in question. In other tests, the Author, by making use of the three salts first proposed by LIVINGSTON (monocalcium phosphate, potassium nitrate and magnesium sulphate) in proper concentrations, succeeded in making *Lemna major* grow normally without any addition of organic matter. The tests prove that these accessory substances cannot be considered as essential to the life of green plants, as are vitamines to that of animals. The author concludes by saying that other investigations are being made in his laboratory with a view to finding out whether these accessory substances on the other hand accelerate plant growth.

L. M.

Influence of Organic Matter upon the Development of Fungi, Actinomycetes and Bacteria in the Soil.

WAKSMAN, S. A. and STARKEY, R. L. (New Jersey Agricultural Experiment Stations). *Soil Science*, Vol. XVII, No. 5, pp. 373-378. Baltimore, 1924.

It has already been noted that the addition of organic matter to soil greatly increases the number of micro-organisms. The authors have systematically studied this phenomenon, making use of various organic matters, and estimating the quantity of micro-organisms by means of the plate method. It has been shown that all organic matter used greatly increases the number of micro-organisms, but not all to the same extent. The action of dextrose is to increase especially the number of bacteria; cellulose, increases fungi; rye straw and alfalfa meal favour both bacteria and fungi; dried blood increases fungi, bacteria and actinomycetes. The addition of nitrate of sodium to the straw treated soil, increases the

number of fungi, without altering that of bacteria; alfalfa increases the number of organisms more effectively than straw, and blood acts still more strongly. The number of fungi increase more in acid soils than in those where the reaction is almost neutral. The numbers of organisms reach a higher point in fertile soils than in less fertile soils. These observations confirm the work done by other investigators, according to whom bacteria thrive most on the dextrose, while fungi mostly develop on cellulose, pentose and other complex carbohydrates.

The majority of bacteria require less nitrogen than do fungi, which require it for building up their mycelia. Cellulose is not attacked by most soil bacteria but is rapidly acted upon by numerous kinds of soil fungi; for this however the presence of nitrogen is required. A. F.

Study of Microbic Flora in Soil.

MARTIN, T. L. (Brigham Young University). *Soil Science*, Vol. XVI, No 6, pp. 475-477. Baltimore, Md. 1923.

The author in his experiments used as green manure rye, oats and buckwheat harvested at three different stages of growth, and made careful observation of the effect on the various microorganisms of the soil. It was shown that non-spore-formers are in a majority in normal soil. The addition of green manures increases the number of the micro-organisms. The fresher the manure the larger the number of actinomycetes as compared with other organisms; there is also less effect on spore-forming organisms.

It would seem therefore that the actinomycetes form a special factor in the decomposition of cellulose.

It is probable that a study of the effects of the various treatments of soil and their relation to various microorganisms, will supply useful data and thus lead to better knowledge of the different soil phenomena.

A. F.

Nitrogen Fixation in Soil and Mannite Decomposition.

WAKSMAN, S. A., and KARUNAKAR, P. D. (New Jersey Agricultural Experiment Stations) *Soil Science*, Vol. XVII, No. 5, pp. 379-393. Fig. 3. Bibliography. Baltimore, Md., 1924.

There is a definite relation between nitrogen fixation of soil and soil productivity as well as between productivity and other bacterial activities. The presence of an excess of available carbohydrates, such as mannite will further the growth of microorganisms which will decompose the mannite and obtain the necessary nitrogen from the air. Nitrogen fixation, when an excess of an available source of energy is added to the soil, depends on the microbial flora of the soil, on chemico-physical conditions, more especially on the soil reaction and on the presence of available salts of potassium and phosphates. Next to nitrogen, phosphorus is the most important element in the nutrition of plants; none of the methods used up to the present, gives any real idea as to the quantity of available phos-

phorus in the soil. This can be done by the method discussed in this paper, namely by measuring the nitrogen-fixing or mannite decomposing power of the soil. A. F.

Bacillus botulinus and *Bacillus tetani* in Soil Samples.

HALL, I. C. and PETERSON, E. C. (Department of Bacteriology, University of California). The Detection of *Bacillus Botulinus* and *Bacillus Tetani* in Soil Samples by the Constricted Tube Method. *Journal of Bacteriology*, Vol. IV, No. 3, pp. 201-209, bibliography. Baltimore, Md., 1924.

The constricted tube method, employing a medium of glucose meat mash, has proved satisfactory in the detection of *B. botulinus* and *B. tetani* in soil. Seventy per cent. of arable soil samples gave toxic filtrates; 65 % contained *B. botulinus*, and 20 % *B. tetani*. These records are of considerable importance, pointing out the origin of *Bacillus botulinus* in preserved foods. A. F.

The Soil Protozoa and their Effect on Crops.

NOVIKOFF M. (Die Bodensprotozoen u. ihre Bedeutung fuer die Bodenkultur). *Akten der von Portheim-Stiftung*. Heidelberg, 1923.

The earliest information on soil protozoa was given by EHRENBERG (1837) and GREFF; this was, however, quite forgotten and these soil organisms did not arouse attention again until the 20th century. E. J. RUSSELL and H. B. HUTCHINSON (Partial Sterilisation of Soil — *Journal of Agric. Science*, Vol. III, 1909) either quickly dried the soil samples kept at a temperature of 55°-60° C., or treated them with reagents prejudicial to organisms. By this partial sterilisation the soil was entirely freed of protozoa, but not of bacteria, which increased rapidly owing to the disappearance of their enemies.

The protozoa might therefore be considered as soil parasites and soil fertility might be increased by their destruction.

KOCH, in his works published in the *Journal of Agric. Research*, Vols. IV & V., 1915, arrived at results somewhat different from the above mentioned. The soil protozoa found by him were the following:

Flagellates:	*Euglena sp.*
	Monas guttula
	Monas vivipara
	Peranema trichophorum
Rhizopods:	*Amoeba radiata*
	Trinema euchelys
Ciliates:	*Paramaecium* sp.
	Colpoda cucullus
	Colpidium colpoda
	Nassula elegans
	Uroleptus musculus
	Vorticella sp.

Glaucoma sp.
Enchelys pupa
Prorodon ovum
Condylostomum patens.

In order to separate the protozoa from the particles of soil, GODFEY had already subjected a small quantity of soil to the action of the electric current and had drawn the active, i. e. non-encysted forms, to the cathode. RUSSELL and GOLDING succeeded in separating them by twice centrifuging the soil sample, suspended in water. MARTIN (*Phil. Trans. R. S. London*, Vol. 205, 1914) recommended mixing the soil with picric acid, whereby the active protozoa are brought to the surface.

KOCH however prefers the simple microscopic examination of the soil sample held in snspension in a little water. In this connection it should be observed that at 22°-24°C. the smaller infusoria develop from the cysts in 1-2 hours, the flagellates in 6-8 hours, the larger infusoria only after 40 hours, while in the well-manured, constantly moist green-house soil active forms are always to be found, which are absent in the normal, moist field soil.

These results of American investigations are diametrically opposed to those of FRANCE as regardst he protozoa who considers " that the edaphon is an indicator of soil fertility ". NOVIKOFF rightly points out that the edaphon does not, like the plankton, form living communities enclosed within themselves ; hence they cannot, without further explanation, be placed in the same category.

The author therefore solved the problem experimentally by investigating the free and the encysted protozoa living in the soil, as well as their oecology, their relations with bacteria and the conditions under which the cysts pass into the free state, and finally also investigated the influence of different artificial fertilisers on the soil protozoa.

Cultures of *Amoeba limax* on agar-gelatine were successfully obtained, this being of special importance in solving the problem. Later, the list of protozoa living in field soil has proved to be much greater than the works of KOCH and FRANCE led one to suppose. The following active and encysted forms were identified :

Flagellates : *Euglena viridis*
" acus
Monas guttula
" vivipara
Oicomonas
Bodo edax
" saltans
Astasia
Peranema
Heteronema
Rhizopods : *Amoeba limax*
" radiosa
" verrucosa

Trinema
Difflugia
Arcella vulgaris
Englypha
Centrophyxis
Mastigamoeba (1)

Ciliates : *Paramaecium anzelia*
" *caudatum*
Colpoda cucullus
Colpidium colpoda
Nassula elegans
Uroleptus musculus
" *dispar*
Vorticella nebulifera
" *microstoma*
Glaukoma
Stilonichia
Urostila
Halteria
Oxytricha
Aspidisca
Chilodon
Plematricha
Urotricha factra
Pleuromema
Lacrimonia olax

All these animal forms belong to the freshwater fauna, and are therefore not edaphic. They live in the soil as it is a suitable medium for their existence, owing to the presence of minute water reservoirs.

They are but little affected by the drying of the soil. At the Moscow Agricultural Institute there were soils which had been dry for 10 years and still contained living cysts; similarly, frozen soils on thawing yielded good cultures of protozoa. Nevertheless, with regard to active forms, moisture is of the greatest importance.

In estimating the importance of the soil protozoa in agriculture, NOVIKOFF's discovery is important, namely, that the number of active protozoan forms existing in nearly all very moist soils is not great (*Colpoda cucullus, Colpidium colpoda, Uroleptus masculus, Vorticella nebulifera, Urotricha factra, Pleurotricha* and *Amoeba limax*). Though these protozoa cause wholesale destruction among the useful soil bacteria, yet, according to NOVIKOFF, this disadvantage should not be very great, for these enemies of bacteria only develop largely in saturated soils, whereas in normally moist soils they usually remain in the encysted state. It must also be considered that the injury done by the soil protozoa is compensated by their influence on the processes of soil decomposition and the formation of humus.

With reference to the question that protozoa are to be considered as

(1) The number of the Rhizopods is much greater (Ed.).

soil parasites or, as FRANCE believes, as an indication of its fertility, the author is of the opinion that the importance of the protozoa in normal soils may be compared with that of those few plants which may indeed indicate certain soil characteristics, but which have no further influence on soil fertility as far as agricultural purposes are concerned.

HERM.' FISCHER.

Partial Sterilisation of Soil by Antiseptics.

MATTHEWS A. *Journal of Agricultural Science*. 14. 1-57. 1924.

Quantitative tests were made of the antiseptic action of substances such as benzene and its homologues and derivatives, carbon disulphide, ammonia, formaldehye and chlorpicrin, on the soil protozoa, bacteria, fungi and eel-worms of the soil. Nearly all the substances quickly disappeared from the soil. The bacteria on the other hand are only reduced in number during the first few days, and then increase to a maximum, afterwards slowly returning to their normal number. In the better aerated and lighter greenhouse soils this process of increase and decrease proceeded much quicker than in field soils, and the greater the molecular weight and heat of combustion of the antiseptics, the quicker the increase generally. The increase in the number of bacteria was independent of the effect of the antiseptics on the protozoa. Both naphthalene and toluene in large quantities, caused a considerable increase in the bacteria, but the former had no influence on the number of protozoa, while the latter killed all the ciliates and amoebae. If the protozoa were killed by large doses of a suitable antiseptic, after a long period the bacteria were still further increased by a second dose. From these results the author concludes that the increase in bacteria is chiefly to be attributed to the feeding effect of the antiseptic on the bacteria and not to the destruction of the protozoa, and that the increased fertility observed by RUSSELL and HUTCHINSON is, in very large measure, a consequence of the decomposition of the soil organic matter, through the increase in bacteria. The increase in bacteria after liming or treating the soil with steam is similarly, partly caused by the decomposition of plant residues. The introduction of a CH_3 group in C_6H_6 decreases the toxic effect on the soil organisms, while a single Cl or nitro-group increases both the toxic effect and the stability of the compounds in the soil.

BERJU.

Factors affecting the Growth of Crops on Acid Soils.

CONNER, S. D. (Purdue Experiment Station, Lafayette, Ind.). *Industrial and Engineering Chemistry*, Vol. 16, No. 2, pp. 173-175. Washington, D. C. 1924.

The author draws attention to the varying nature of soil acidity.

KAPPEN has distinguished: (1) *free or active acidity* (measured by the hydrogen-ion concentration); (2) *[illegible] acidity*, due to aluminium silicates, iron, manganese, estimated by the action of a strong acid salt e. g. nitrate of potassium); (3) *hydrolytic acidity*, which may be determined

by deducting the accessory acidity from the total acidity (determined with lime water or by the acetate method).

The accessory acidity is most harmful to crops, as in the soil it causes the formation of hydrogen-ions, and aluminium-ions both recognised as injurious to the growth of crops. Acidity due to organic acids is only slightly injurious; it seems even that the organic substance reduces the toxicity of the other more active acidities. By HOPKIN'S (potassium nitrate) method the accessory acidity, which is for the most part mineral acidity, is measured. The total acidity (accessory acidity + hydrolytic or mineral acidity + organic acidity) is measured by JONES' (acetate of lime) method. By deducting the acidity obtained by HOPKIN'S method from that obtained by JONES', we have, very approximately, the amount of organic acidity. The author in his numerous tests has found that the formula $K = H^2/I - H$ gives *an excellent index for the correction of soil acidity*, both in the case of mineral and organic acidity.

The Author in giving the practical results of his tests, points out that the toxicity of acid soils is due as much to aluminium-ions as to hydrogen-ions. The results of his tests also show that some crops are more affected by aluminium-ions, others by hydrogen-ions.

In conclusion the Author, from the results of his practical tests, advises that, to correct this injurious effect on crops both phosphates and lime should be added to acid soils.

L. M.

The Injurious After-Effects of Sorghum.

BREZEALE, J. F. *Journal of American Society of Agronomy*, Vol. 16, No. 11, pp. 689-700. Geneva, N. Y., 1924.

The author made a study of the residual, or after-effects of sorghum, which cause injury to plants of other crops that follow in rotation, and also, the effect of sorghum on the physical condition of the soil.

The results of the experiments made indicate that: (*a*) The injurious after-effect of sorghum is due to the presence of a toxic substance formed during decomposition of the stubble; (*b*) this toxic body is readily volatilised or decomposed; (*c*) during the decomposition of the stubble the soil flora that generates carbon dioxide is, to a large extent, killed off; (*d*) with the cessation of the formation of carbon dioxide, a new equilibrium is established in the soil, in which the sodium zeolite exists in excess of the calcium salt and causes deflocculation of the soil.

W. S. G.

On the Mortality of Firs in the Wienerwald.

LEININGEN, Prof. Dr. Wilh. Graf zu, Vienna. (Uber das Jannensterben im Weinerwalde). *Forstwirtschaftliches Centralblatt*, No. 5, p. 173-183, Berlin, 1924.

After the dry years 1917 and 1922, the white firs of the Wienerwald were destroyed over large stretches of country, especially the older trees with shaky tops. The immediate cause of this wholesale destruction was

generally considered to be the attacks of beetles and to some extent also fungoid disease.

So far as its course may be seen at a glance, the damage followed a west to easterly direction, without it being possible however, to attribute a definite effect to the difference in rainfall, which diminishes towards the east. There was a tendency consequently to seek the cause of the damage, in part at least, in the soil, especially as the exposure to weather conditions seemed to bear little relation to the degree of mortality.

The soils of the Wienerwald very greatly in the sandstone (Flysh) zone; they are partly marly, but mostly poor in lime, light (with subsoil of almost pure quartz sand) to very heavy; the latter absorb large quantities of water, but dry out in summer to a great depth, becoming cracked and hard. Only the beech shows good growth on soils very poor in lime (optimum climatic conditions). The principal humus form is " Mull ", which gradually changes into humous soil. Nitrification proceeds quite regularly; the more ornamental forest types were found to predominate (the CAJANDERS type). Some danger however lies in the fact that the fusiform roots of the white fir become stunted in heavy soils, through twisting back, and the root system of the beech also does not penetrate very deep; both trees show their principal root development in the upper soil layers, which are very dry during the summer. On lighter soils the roots penetrate to the lower layers, so that there is no danger here as regards the summer water supply; neither in this case is there any bending back of the roots. The analysis of the soil (by the ATTERBERG method) gave, for the heavy Wienerwald soils, a clay content which was almost as great as that of many red earths, which accounts for such a high degree of heaviness and impermeability.

From these and other considerations, such as the quantity of precipitation during the summer months, it may be safely concluded that, the mortality among firs in the Wienerwald is caused by the exceptionally low precipitation during the growth period of certain dry years; that white firs thrive better on light soils than on heavy ones, and that the damage caused by insect pests and fungi on trees already in a very poor state must be considered as secondary only. Nevertheless, in consequence of a large increase of insects injurious to forest growths, this damage may afterwards, owing to beetles, become of primary importance. AUTHOR.

Soil Cultivation and National Farming.

SCHNEIDER Cl. (Forestry and Farming Engineer), plates [illegible]. Helwingsche Verlagsbuchhandlung. Price M. 2.40. Hanover, 1925.

The auther is investigating from the point of view of a universal synoptic scheme the statics of economic relations in world and national agriculture, to which there must be recourse on the basis of a kind of natural valuation by way of an intensive increase in soil productivity. Statistical tables and sketch diagrams show the necessity of keeping this end in view, to the attainment of which soil science indicates new and promising paths. New fields of enterprise are thus offered to technologists

with the participation of capital in large scale cultivation, and new chances of employment to labour. The relations with the colonies and Turkey are carefully examined, and in connection with the scheme for intensive cultivation consideration is also given to ethics, education and art, all of which are furthered by improvements in the soil. Y.

Origin of Alkali Soils and Physical Effects of Treatment.

JOFFE, J. S. and McLEAN, H. C. (New Jersey Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 1, pp. 13-30, bibliography, figs. 8. Baltimore, Md., 1924.

Among the various theories on the origin of alkali soils, the authors examine that of GEDROIZ, according to whom, from the reaction of zeolitic soda with carbonate or bicarbonate of lime, zeolitic lime and carbonate of soda are formed, without the zeolitic portion entering into solution. Instead of which, it is a question of a phenomenon of adsorption. The reactions of the zeolitic portion are of a superficial character and it is clear therefore that the degree of particle dispersion is of considerable importance, especially in alkali soil, in which the colloidal content is high. According to HILGARD, the reactions between soda and lime compounds take place in the soil solution and are therefore of a purely chemical nature. DOMINICIS' theory is analogous to that of GEDROIZ: according to the former, the hydrogels, formed by a process of substitution in certain combinations of silicates and humates, change into hydrosols. The separation of the soda and the formation of sodium hydroxide take place, and the latter combines with the carbon anhydride.

In order to improve alkali soils, therefore, either the soda in the complex silicate should be substituted (GEDROIZ's theory) or the colloids should be coagulated (DOMINICIS' theory), and finally the excess of soluble salts should be washed out. These fundamental principles should therefore be followed: 1) coagulate the colloids; 2) wash out the excess of soluble salts; 3) substitute the zeolitic cations; 4) create a favourable reaction for plant growth; 5) compensate the losses of nutritive substances caused by improvement methods.

The results of the authors' tests show that the alum treatment improves soils, but only temporarily, inasmuch as the alkalinity soon returns. If a simple washing-out could carry away the soluble salts and render the soi productive, it would be advisable to coagulate the colloids and increase permeability by the addition of alum, but this temporary remedy cannot be considered as a scientific treatment of alkali soils.

Favourable results are obtained by large additions of sulphur. The sulphuric acid hydrogen-ions formed are sufficient to substitute the cations in the zeolites and prevent the formation of carbonate of soda, and result in the formation of neutral sulphates.

Nothing conclusive can be reduced from the peat treatment tests.

A. F.

The Formation and Origin of Loess.

GANSSEN R. (Gans.). Die Enstehung und Herkunft des Loess. *Mitteilungen aus den Laboratorien der Preussischen Geologischen Landesanstalt*. Part 4, pp. 10. Berlin, 1922. Copies may be obtained from the Preussischen Geologischen Landesanstalt, Berlin No. 4, Invalidenstrasse, 44.

The author does not consider that the explanation hitherto given of the formation of loess is satisfactory, and in continuation of the views laid down in his work on the climatic soil conditions of clay silicates, gives the following conception of the formation of loess: "Loess is a formation due to temperature, but to the temperature of the soil rather than the air. It is the product of the arid, hydration-decomposition of a fine-grained, alkaline, clay-silicate, lime material, undecomposed, deficient in clay and rich in silicic acid, the gradual formation and arid decomposition of which in the temperate zones is to be traced to the influence of wind." It is further advanced and established that, though the principal part of loess is composed of grains of from 0.01-0.05 mm., the finest particles, under 0.01 mm., also contribute to the formation of loess, and further, that deposits of every kind may also aid therein, so long as their finer parts correspond to the above-mentioned conditions as regards composition and size of grain. Finally, the coloration of loess is explained and the cooperation of the subsoil under special conditions in loess formation is discussed. H. HALLER.

On Peat.

SPIRHANZL, Ing. J. O. Ueber Torf. Prague, Czecoslovakia, 1924.

In this book the author describes the general properties of peat, such as water capacity, hygroscopicity, power of absorption of gases, its true and apparent specific gravity, cohesion, elasticity, capillary attraction, heat conductivity, effect of heat, and its acidity.

The formation of peat-moors is then dealt with and their geographical distribution and extent in Czecoslovakia, are discussed and shown on a map.

In the last chapters the author treats of the cultivation of peat-moors, drainage, fertilisation, etc., and the means by which they may be rendered serviceable to agriculture, gardens, and in various industries of the Czecoslovakian Republic.

The appendix to the book contains a full index of the literature on this subject. L. SMOLÍK.

Desert Formation in Present and Past Times.

WALTHER JOHANNES, Halle. Das Gesetz der Wuestenbildung in Gegenwart und Vorzeit. 4th revised edition, pp. 421, illustrations 203. Published by Quelle & Meijer. Leipzig, 1924.

The well-known work of WALTHER now in its 4th edition, has been greatly enriched by the more recent investigations of the author, and special mention should be made of the excellent illustrations.

There is scarcely a chapter in this book that does not add something to our knowledge of soil science (though the book is primarily intended for geologists and geographers), but throughout the whole the chief note is the great importance of climatic factors in the formation of the earth's surface, decomposition, transportation, deposition and formation of soil. The author, from personal observation of different types of deserts in various parts of the globe has obtained a clear idea of the character of deserts at the present time, and as a geologist, draws conclusions respecting the deserts of the past.

An equable, temperate climate with regular precipitations is termed " isonom " by WALTHER, and is contrasted with an antinomial climate, full of extremes, in which not only are there large quantities of moisture in the atmosphere owing to the extensive evaporation of a tropical sea and heavy precipitations in all zones, but where, at the same time, the increased heat of the sun quickly disperses this moisture. Many phenomena can only be explained by a heavy flooding and simultaneously an intense evaporation of the upper layers of the soil. The laterite soils have been produced by such a climate, but to-day antinomial climatic conditions do not exist on our planet. Laterite soils are, according to WALTHERS, decomposed masses contemporaneous with earlier climatic conditions. The rainy tropical climate of the present day destroys the laterite soils in the same way as it does red earth, which often dates from the diluvial period and had been deposited in the chasms and fissures already existing at that time (discoveries at Capri of diluvial fauna and paleolithic tools in a red earth of 5 m. thickness).

The lake at Thebes had no outflow in diluvial times, and in spite of heavy precipitations the Nile in Lower Egypt dried up in consequence of the intense evaporation and did not reach the sea. This is mentioned as an indication of the effect of the fundamentally different climate of that period as compared with the present time.

In the first part, " The Character of the Desert ", the effect of the sun and evaporation (separation of lime compounds from the water of the Nile, many rocks, e. g. sandstone, disintegrated and fissures formed, decomposition of salts and gypsum) and the action of the wind in transporting soil particles, which has the greatest effect where a desert land is subjected chiefly to a wind blowing constantly from the same direction.

The flora of the desert is dependent on the possibility of obtaining water, either from the soil, or as rain, and also on the sun's rays, wind-drying, mobility and salt content of the soil.

The second part of the book treats of denudation in the desert; transporting forces only effect loose material. Gravitation, wind transportation, erosion and the results of glacier ice, also abrasion in coastal districts, here come into play. Long after the wind has lost its carrying power signs of its former influence are found.

Disintegration is particularly well shown on the ancient Egyptian monuments, the exact age of which is known. In answer to the statement that WALTHER has sought to explain all desert phenomena by physical causes without reference to water and chemical decomposition, he replies

that the desert phenomena are on the contrary polydynamic, the actions taking place in the desert to-day having a constant and mutual influence on one another.

The climate of Egypt has not changed during the last 4000 years. During this period disintegration of the monuments has been going on uninterruptedly and has not yet ceased. Weather-worn remains of walls, the wearing of holes in, and the effects of insolation on statues, the scaling and splitting of rocks, all give clear pictures of the changes taking place. The wearing away in arid zones is contrasted with the inroads made in moist and rainy climates, such as washing away of the earth's crust. The formation of a hard and deep crust forms a sharp contrast to the softening of rock crystals. The origin of numerous phenomena in regions with no outflow, is only partly to be attributed to erosion through running water; the rest is due to transport action. Wind is the decisive lifting and moving force in desert denudation. Transportation may indeed take place without corrosion, but not the converse. A covering of stones protects against transportation. The author then describes in detail the various forms of desert denudation such as pot holes, amphitheatres, networks, the removal of knolls and dunes, etc.

In the third section: "Accumulation on the Desert", a great deal of space is given to desert sand or dust, as a very important factor; then also the chemical deposits (salt deposits of recent and early formation), and the relation of the desert to marine sediments, etc., is discussed.

In the fourth section: "The Desert in the Past", the author alludes to a type of desert which is no longer to be seen, namely the lifeless original desert; and further, of tropical deserts with no outflow for streams, in which the greater the number of water courses which end therein, the more arid is the desert. The cold glacial desert is also greatly affected by wind transport action. The chapters: "The Allocation of the Weather Zone" and "Change of the Sun's Rays", also "The Diluvial Snow Period and the Desert", are of special importance for they also have a direct bearing on soil science.

In the last chapter are discussed loams, ferretto, bauxite, red earths, loess and laterite, the last being very fully treated.

A complete index of the contents very considerably facilitates the study of this valuable work. LEININGEN.

Genesis and Geography of Russian Agricultural Land.

GLINKA, K. Genesis und Geographie der russischen Boden, pp. 78. *Panrussian Agricultural and Mechanical Arts Exhibition.* Petrograd, s. d.

The author, after a clear introduction in which he examines the conditions in which agricultural land is being formed, gives a brief description of the five principal soil types.

1) Laterite, found especially in the tropical zones. 2) Podsol, the name of which is derived from the Russian "zola" (ashes), on account of the white or grey colour of such soil. It is chiefly found in the forest regions with a rather cold climate; compact, and rich in concretions.

and contains, iron, manganese and humus. 3) Steppe, the most widely diffused and most widely investigated type of which is the Chernos ("Tschernos"). 4) Marsh. 5) Solonetz, which includes soils, of which the upper part of the humus crust is looser and lighter in colour than the lower part, from which salts, generally of lime, are separated. There are different varieties of this soil, which is found also in Rumania, Hungary, Spain and the western parts of the United States, in addition to Russia.

The author then considers the varied and extensive areas of land in Russia. The *Tundra*: A zone characterised by a low temperature (mean annual from -12° to -17° C) and by low rainfall, never more than 300 mm., sometimes less than 200. Such low precipitation renders the conditions of the tundra nearly like those of desert zones, but as a consequence, there is a hypersaturation of moisture, which favours the formation of the marshy type. Bed rocks are represented especially by marine sediments (and sand), clearly stratified with marine fossils. Here and there also rock crystals are found. The surface is varied. In some places there are quite sterile patches, deprived of humus, which approximate such soil to the podsol and solonetz type. Elsewhere the surface is covered, to a depth of 30-60 cm., by a peaty layer of a dull green or light grey colour. The peat may form hillocks of as much as 5-25 m. in diameter and 3-5 m. high. In the valleys and in places exposed to marine inundations there is the salt marsh soil, with a growth of halophitic plants. The tundra zone, the extent of which is not yet fully known, gradually passes into the forest zone.

The *podsol zone* is very extensive and is characterised by low rainfall. The mean annual temperature is slightly above 0°C in European Russia and below 0°C in Asiatic Russia, where the soil is perpetually frozen. The bed rocks are composed of sediments of the glacial period. In the moraines, the stones transported by the ice are sometimes in such quantities as to form vast spaces quite unfit for cultivation. The moraine elevations generally run in definite directions and are surrounded by enormous quantities of rocks and stones. The sediments may be considered as of fluvio-glacial origin. Not far from the moraines are vast sandy surfaces, also coming from the glacier waters. The moraine deposits are then covered with silt ; towards the south are sandy islands rich in limestone. There are also marine deposits in European Russia, while in Eastern Siberia are found rocks and crystalline schists.

The nature of the surface of the soil is influenced by the climate as well as by the rock composition. Thus in the North-West zone, where great moisture prevails, the formation of the soil is similar to that of the steppes, with its characteristic flora (*Stipa pennata*) and fauna (*Spermophilus*). The nature of the soil, both of the clay masses and of the surface mud, forming an alluvial layer, is connected with glacial action. The soil formation is quite superficial where the bed rocks are hard stones, as in Eastern Siberia. Here, owing to the presence of red sandstone, the characteristic colorisation of the podsol is absent.

In the *steppe* or *Chernos zone*, the temperature varies ; in the plant-

growth period it is about 13°; in some places however the mean annual is 5°C, while in other it falls below 0°. Atmospheric precipitations are as much as 400 mm., except in Eastern Siberia, where they are less and where the soil is perpetually frozen. As bed rocks, sand (loess) predominates, but there are also silt, clay, chalk and granite. As regards the primary vegetation of the steppe, the author excludes the possibility of its having been marsh or intensely forest, maintaining instead that it was mostly herbaceous. At present the forest is formed of oaks, conifers or aspens. The soil surface stratum is far from uniform and there are different varieties.

There is no clearly defined boundary line between the *desert steppe zone*, with chestnut coloured or brown soils, and the preceding. The temperature is slightly higher, atmospheric precipitations are lower, and the soil in some places is perpetually frozen to a depth of 2-2.5 m. The bed rocks are silt, clay, sandy silt, originating from the Caspian Sea deposits. Vegetation passes from *Stipa* and *Festuca* to *Artemisia* and *Ceratocarpus arenosus* towards the South. In some zones there are quicksands; the earth is also frequently covered with fissures of 0.5-3 cm. in width. Some regions also show a hillock formation, 40 m. in diameter and 1.5-2 m. high, surmounted by a crater-like summit whence issues mud.

In the *grey desert steppe zone* (*Solontschak soil*), the brownish colour of the preceding zone passes to grey in the valley of the Syr-Darjia and to whiteish grey in the plains of South Russia. The mean annual temperature of this zone is above 10°C, but precipitations are very slight, so that the zone is rather arid. The bed rocks are formed of sand deposits, stones and pebbles. The soils are salt, except in the low zones of Turkestan, which are sufficiently drained.

With regard to the *mountainous regions* and the *Crimea*, there is, in the neighbourhood of Jaila, a chestnut-coloured soil (with 3 % of humus). At the eastern extremity is the pass to the desert steppe. Elsewhere there are forests, with clayey soils, passing from red-brown to light-coloured. The mean annual temperature in the uplands is 5°C, atmospheric precipitations 600 mm.

In the *Caucasus*, atmospheric conditions are very varied, for regions with 2000 mm. of precipitation are succeeded by those with 300. There are consequently various zones of vegetation and of soils, from that of the steppe to those of forest and lofty mountain regions.

In the *Urals*, the soil is of the podsol type in the N., and the Chernos type in the centre, and chestnut-coloured in the S.

With regard to the *Altai*, in the plain and undulating regions there are chestnut-coloured soils, with few sulphates and chlorides and with 3-4 % of humus. In the north, this rises to 8 % and there are many salts at a depth of 15-55 cm.

In *Turkestan*, two horizontal soil zones, the brown and grey, and two vertical, may be distinguished. In the lofty mountain desert zone (Pamir), with a very low temperature and extremely dry atmosphere, there is a purely surface soil only, sandy-quartz, with scanty graminaceous vegetation.

The author concludes his observations by pointing out the regularity of soil distribution throughout the world ; the new soil geography data render these geographical charts simpler and clearer.

A. F.

Italian Forest Soils.

I. EDLMANN, L. Analisi del terreno forestale di Camaldoli. *Annali del R. Istituto superiore dorestale fazionale*, Vol. I, pp. 27-38, 1 plate, bibliography. Florence, 1924.

II. — *Idem*. Il terreno forestale della Verna. *Annali del R. Istituto sup. forestale nazionale*, Vol. IX, pp. 39-53, 1 plate, bibliography. Florence, 1924.

I. After a short description of the forest domain of Camaldoli, the author touches on the geological formation and the climate of that region ; and after having given the results of the microscopic and chemical examination of the rocks, from the alterations of which, in great part the Camaldolian forest soil originates. Data are given respecting the analyses and the physico-chemical and chemical composition, of the samples of soil taken at various depths in a section of which the lithological basis of the lateral section is a slightly calcarerous sandstone (1.60 % CO_2) and in another plot where, on the other hand, the basal rock is a sandy limestone with 26.82 % CO_2. The data are completed by the acid determinations made on various samples by the colorimetric method.

II. The author describes briefly the geological composition of Monte Penna, which rises to a height of 1283 m. in that part of the Appenines which, between the Serra and Catenaia Alps, divides the upper basin of the Arno from that of the Tiber. He then gives the results of the microscopic examination of some thin sections of the rock (miocenic lime and sandstone), from which the soil covered by the dense Varna forest chiefly originates, and the data of the chemical analysis of two samples of rock, the lithological basis of the forest soil, from one zone covered with spruce only, and from another covered with mixed spruce and beeches. The mineral soil directly overlays the live rock, the intermediary strata of altered rock being absent, and has various gradations of colour and composition, owing to the large quantities of organic matter present near the surface. Data are given of the mechanical, physico-chemical and chemical analyses (total composition and the composition of the hydrochloric acid extract) of the samples taken at various depths from lateral sections of the two zones mentioned. The result of the acidity determination made by the colorimetric method is given for each sample. The author observes that the Varna soil furnishes acqueous extracts with an acid reaction, both under the spruce wood and under the mixed plantation.

AUTHOR.

Additional Information on some Soil Types in Java and Sumatra.

Loos H., Bijdrage tot de Kennis van einige Bodensoorten van Java en Sumatra, 8vo, pp. 210 XV plates. Veenman & Zonen, Wageningen, 1924.

This work has been carried out under the direction of Prof. van Baren at the Agricultural High School at Wageningen, Holland, and is divided into 5 sections and 2 appendices.

In the introduction, the author explains how his duties as Agricultural Adviser in the Dutch Indies led him to study the soil, and during his leave of absence in Holland, to pursue these studies further. In the first section of the work is described the investigations carried out on soil minerals, and in the second part the methods of investigation themselves are discussed. The author gives some valuable information on the determination of the optical properties of the soil-forming minerals. In the third section is given a description of 35 different minerals and some organisms, which were found in 6 different kinds of soil of a very heavy type, from the agricultural centres of Java and Sumatra. This section is illustrated by 14 tables and 153 photo-micrographs.

In the fourth part of the work is discussed the method which should be adopted in arranging the results of mineral investigations in order to draw definite conclusions therefrom; it is suggested that comparisons be made of the quantitative mineral determinations, by means of the magnetic process, basing on the specific weight or the optical qualities. The author prefers the last-named method, and has discovered a quantitative optical method, in which he makes use af a Nebeltau microscope. The quantitative value can be determined by comparing a large number of samples by this optical method.

In the last section, the 6 soil sections examined are described, and the minerals found therein are again discussed, and in conclusion a general survey of the minerals is given, and the probable bedrock for each mineral is added. The appendix includes a further description of the minerals found, on the basis of recent literature on the subject, with critical notes by the author, a full bibliography being given. X.

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General Notices.

The "International Reports on Soil Science", which was originated in 1911 by resolution of the II International Soil Science Congress at Stockholm, came to an end in 1924. The Reports which are still available may be obtained from the Publishers, F. Wunder, Berlin NW., 23, Cuxhavenstrasse, 2.

The IV International Congress at Rome in May 1924 decided to publish the review in a new form as the organ of the recently established "International Society of Soil Science", starting in 1925 and beginning with this issue, as a part of *The International Review of the Science and Practice of Agriculture*, published by the International Agricultural Institute in Rome. It is hoped that the review in this new form will continue to be useful to soil science.

As general editor I must ask indulgence, if in this first number the summary of soil science literature is somewhat incomplete, but the new organisation should soon make good this deficiency. All communications regarding this publication should be addressed to the under-signed

The Editor: Prof. Dr. F. SCHUCHT,
Berlin-Wilmersdorf, Güntzelstrasse, 50.

The International Society of Soil Science. — The International Society of Soil Science was founded on the last day of the fourth International Soil Science Congress held in Rome, on Monday, May 19th 1924. It is hoped to give detailed information respecting the Society in the next number of the Review, especially as to the composition of the Executive Committees, of the International Sub-Committees and of the national sections formed in the different countries. If possible, the statutes and the list of members will also be published in that number. Brief notices only are given here.

In accordance with Par. 2 of the statutes the object of the Society is the encouragement and promotion of soil science in general by means of:

a) the organization of Congresses and Conferences;

b) the formation of sectional and other committees;

c) the publication of a review;

d) the establishment of a central office for soil science literature and documentation at the International Institute of Agriculture in Rome.

For particular countries separate sections may be formed within the Society, for the study of soil science in general or of special branches of the subject. Every section with more than 15 members has the right to representation on the General Committee by one of its members.

Constitution of the Society:

a) the Executive Committee;

b) the General Committee;

c) the Sub-Committees.

The following persons constitute the Honorary Committee of the Society.

Prof. Dr. E. Rahmann; Prof. Dr. L. Cayeux; Prof. Dr. C. Glinka; Prof. Dr. Jozef Kopecky; Prof. Dr. G. Murgoci; Sir John Russell; Prof. Dr. Winogrannsky.

The following persons were appointed at Rome to form the Executive Committee:

President: Prof. Dr. Jacob G. Lipman.

Acting President: Dr. D. J. Hissink.

Vice-Presidents: Prof. Dr. G. de Angelis d'Ossat, Dr. Benjamin Floderus.

Editor of the Review: Prof. Dr. F. Schucht.

A representative of the International Institute of Agriculture in Rome;

General Secretary: Dr. D. J. Hissink;

Librarian: Dr. G. Borghesani.

The following were elected to form the General Committee:

Prof. André, Prof. Aso, Dr. Christensen, Prof. Hesselman, Dr. Miklazewski, Prof. Novarese and the presidents of the six International Commissions:

1) for the study of soil physics, Dr. Novak;

2) for the study of soil chemistry, Prof. Dr. von Sigmond;

3) for the study of soil fertility, Prof. Dr. Mitscherlich;

4) for the study of soil bacteriology, Prof. Dr. Stocklasa;

5) for nomenclature, classification, and soil mapping, Prof. Marbut;

6) for the application of soil science to agricultural technology, Dr. Girsberger.

Any individual or body corporate interested in soil science, is eligible for ordinary membership.

Members of the society are entitled is receive the Review free of charge on payment of the annual subscription.

It was decided in Rome to fix the contribution for the year 1924, which is to be regarded as a foundation subscription, at 2 American dollars. The subscription for 1925 will be fixed by the Executive Committee, according to the statutes. It has been suggested that this should be f. 6.50 (Dutch gulden) with an entrance fee for new members of f. 2.50. New members are asked to communicate with the General Secretary, enclosing their annual subscription and giving full particulars respecting name, title, Institution, address, etc. Every member is asked to send the annual subscription for 1925 to the General Secretary, together with the admission fee, before the 1st of April.

In accordance with par. 12 of the Statute the Executive Committee shall summon a Congress at least every five years, by arrangement with the International Institute of Agriculture at Rome. It was decided in Rome to hold the first Congress of the New Society in the United States of America.

The International Sub-Committees and the National Sections have the right under the rules of the Society to determine their own constitution. It is clear however that only members of the Society can be members of the committees or section.

The presidents of the Sub-Committees or sections are asked to inform the General Secretary as to the composition of the executive committee and other particulars relative to their committees before the 1st of April 1925.

About 300 members have paid the foundation subscriptions of 2 dollars up to the 1st of January 1925. Every member is asked to do whatever may be possible to make the new Society known among persons interested.

Gröningen, Jan. 1st, 1925.

Dr. D. J. HISSINK,
Acting First President and General Secretary,
The International Society of Soil Science,
Hermann Colleniusstraat 25, Gröningen (Holland).

AGRICULTURAL INTELLIGENCE

AGRONOMY

Agricultural Meteorology.

1. Sulphur and Nitrogen in Rainfall in Kentucky.

I. JOHNSON, E. M. Sulphur in Rainfall in Kentucky. *Journal of American Society of Agronomy*, Vol. 16, No. 6, pp. 353-356, tables 4, bibliography. Geneva, N. Y., U. S. A.

II. FREEMAN, J. F. Nitrogen in Rainfall in Kentucky. *Ibidem*, pp. 356-358, tables 3.

I. — The author quotes the amounts of sulphur found in rainfall by twelve other workers, ranging from a maximum of 94.5 lb. per acre per annum, recorded at Knoxville, Tenn., 64.58 lb. at Leeds, England, 5.98 lb. at Lincoln, New Zealand, to a minimum of 0.61 lb. at Mt. Vernon, La.

The annual precipitation of sulphur, per acre, as recorded from 7 centres in Kentucky, from April 1921 to April 1923 averaged 29.52 lb., the maximum precipitation being in January, February, March and the minimum in July, August and September.

II. — With an average rainfall of 42.76 inches from April 1, 1922 to April 1, 1923, in six different localities in Kentucky, the soil received an average of 18.78 lb. of nitrogen per acre. Of this, 11.61 lb. was in the form of ammoniacal nitrogen and 7.17 lb. was in the form of nitrate nitrogen. W. S. G.

2. Wheat Yield and Rainfall in Ohio.

WELTON F. A. and MORRIS V. H. *Journal of the American Society of Agronomy*, Vol. XVI, No. 11, pp. 731-749, figs. 9, bibliography. Geneva, N. Y. 1924.

It has been suggested that the high yields of wheat obtained when wheat follows a crop of potatoes, may be partly due to a high nitrate content of the soil, and the accumulation of nitrates may be dependent on a low rainfall.

The author's studies of statistical data indicate that in Ohio a decrease of rainfall is accompanied by an increase in wheat yield. Sub-normal rain-

fall is more beneficial in autumn and early spring, than in the winter or late spring. Sub-normal rainfall in November and April appears to be most beneficial. Wheat yields are probably depressed in most years by too much rainfall. W. S. G.

3. Relation between Climate and Sugar Production in Java.

TENGWALL T. A. and VAN DER ZYL C. E. (Proefstation voor de Java-Suikerindustrie). Het verband tusschen Klimaat en suikerproduct op Java. *Archief voor de Suikerindustrie in Nederlansch-Indie*, No. 4, pp. 65-130, figs 18. Soerabaja, 1924.

Sugar production in Java has now for some time shown a constant increase, but also considerable oscillations from one year to another. The Authors investigate the causes of such increase, which is really very great, for, from 22.8 *Pikul* (1 Pikul = about 62 kg.) per *bouw* (1 bouw = m² 7.095) in 1839, it rose to 129.1 in 1923.

Apart from other factors, such as progress in irrigation, in cultural methods etc. the Authors find that the crop is greatly influenced by climatic conditions. Among these, particular attention is given to the monsoons and rains, which latter are very abundant (from a minimum of 1.314 m. per annum to a maximum of 3.388 m.). By applying the formulae of the statistical method, the Authors find that it is possible to establish a correlation factor between sugar production, the October and November rains and the time of planting. This factor is 0.88 and enables the year's crop to be calculated very approximately when the October and November rainfall and the time of planting are known, it being remembered that between the latter and the harvest there is an interval of nine months. With the same data the yield also may be calculated; in this case the correlation factor is 0.95. A. F.

Soil Science.

See R. Part II. *Proceedings of the International Society of Soil Science.* Abstracts.

Fertilisers and Manures.

4. Liming of Assam Soils.

MITRA, S. K., and DUTT, S. C. *Department of Agriculture, Assam, Bulletin* No. 2, p. 3, 1923.

In various parts of Jorhat, it has been observed that certain seeds, such as oats and barley, do not germinate, even in well fertilised soils. Analysis has shown that this is due to excessive soil acidity, the soil being an ancient sandy alluvium characteristic of many parts of the Brahmaputra valley. Such soils should therefore be corrected by liming.

The effects of this liming are : 1) chemical (neutralisation of acidity, alteration of potassium compounds and insoluble phosphates) ; 2) physical (clay soils are rendered less adhesive, sandy soils on the other hand become less loose and so hold water better, while their porosity is also increased) ; 3) biological (decomposition of organic substances, which are rendered available, favourable action on nitrifying organisms).

In light dry soils a small quantity of lime is applied : to every biggah (= 1337.7 sq. metres), 2-6 maunds (1 maund = 38.868 kg.) of quicklime, 3-8 of slaked lime, or 4-10 of carbonate of lime ; to clay soils containing much organic substance, double the quantity is used. The quick or slaked lime is spread as powder after the rains and ploughed in, and one month elapses before sowing ; the carbonate of lime (crushed limestone) is applied at any time. The application is then repeated every 3-4 years.

A. F.

5. **Analysis of Gypsum and Gypsum Products.**

WELCH, F. C. (Bureau of Standards, Washington, D. C.). *Industrial and Engineering Chemistry*, Vol. 16, No. 3, pp. 238-341. Washington, D. C., 1924.

The author mentions the forms in which sulphate of lime is most commonly found. In nature the two forms to be considered are : gypsum ($CaSO_4$, $2HO_2$) and anhydrite ($CaSO_4$). In the gypsum industry, on the other hand, four well defined forms of sulphate of lime are to be considered : 1) gypsum ($CaSO_4 . 2H_2O$), 2) calcined gypsum or hemihydrate ($CaSO_4$ $\frac{1}{2}H_2O$), 3) soluble anhydrite ($CaSO_4$), 4) natural anhydrite ($CaSO_4$). These various forms may be easily distinguished under the microscope, whereas no method of chemical analysis hitherto in use will determine how much of each form is present. The method described by the author in this note enables the quantitative determination of each of the forms of sulphate of lime to be given.

Briefly, the method proposed consists in determining : 1) the *hygroscopic* water content by heating the sample under examination to constant weight in a current of air with a vapour pressure slightly greater than the dissociation pressure of gypsum at the temperature used for the experiment ; 2) *total water in combination* content of the sample, already evaporated as above, at a temperature of 200°C, to constant weight ; 3) *the quantity of water the sample is capable of reabsorbing* after having undergone the two above-mentioned treatments. This last determination is made by passing over the sample, in which the hygroscopic water content and total water in combination have already been determined, the sample having been cooled to the surrounding temperature, a current of air previously passed over 25 N. sulphuric acid. The operation is continued until no further increase in weight is registered.

From the total combined water, water taken up by the sample from 25 N. sulphuric acid to form $CaSO_4$ $\frac{1}{2}H_2O$, and analysis for CaO and SO_3, the amounts of gypsum, calcined gypsum, soluble anhydrite and natural anhydrite present in the sample may be calculated.

L. M.

[5]

6. The use of Artificial Fertilisers and Oil-Cake Residues for Tobacco Crops.

BARTELS, P. M. Onderzoekingen over de Mogelijkheid van Vervanging van de Gebruikelijke Dessa-aarde of Stalmest door Boengkils of Kunstmeststoffen. *Proefstation voor Vorstenlandsche Tabak*, No. 51, pp. 1-141, Mededeeling, 1924.

Farmyard manure and "Dessa" earth, much used in Forstenland for fertilising tobacco plantations, may be infected with *Phytophthora nicotianae*. As this fungus may cause great injury to tobacco plantations, the Experimental Station at Klaten is seeking a means of preventing the spread of this fungus, by replacing organic by artificial fertilisers. The latter, however, might to some extent be injurious to the physical condition of the soil; tests were therefore made first with various cake residues (*Soya hispida*, *Cocos nucifera*, *Eriodendron anfractuosum Jatropha*, a mixture of *Arachis* and *Eriodendron*). These were applied in such quantities that the nitrogen was equivalent to 6 grams of sulphate of ammonia per plant, and sprinkled as powder in a furrow, in which planting was to take place 3 weeks later, care being taken to mix well into the soil. The results were good in all cases; the fertiliser quickly became transformed into easily assimilable matter for the plants, which can derive benefit therefrom even when young. Unsatisfactory results were obtained with sugar molasses.

Sulphate of ammonia as a fertiliser seems insufficient, especially as regards the length of the lower leaves. Better results are obtained by adding phosphate to the sulphate. Some elevated sandy soils however require farmyard manure or "dessa" earth. In some soils the use of artificial fertilisers has no appreciable effect on yield, which was the same as when farmyard manure had been used. A. F.

7. Walpole Island Phosphate Deposits.

WRIGHT, A. M. *New Zealand Journal of Science and Technology*, Vol. VII, No. 2, pp. 91-94. Wellington, N. Z., 1924.

Walpole Island is a dependency of New Caledonia and is thus under French administration, by whom it has been leased to the Austral Guano Company.

The phosphatic guano is found as a chocolate-coloured, loose earth, in depressions of the coral rock on the top of the island; there is little doubt that the deposits originated from bird excrements.

An analysis from a composite sample representing 2000 tons of the guano gave the following percentage results: Water (hygroscopic) 11.32, water (combined) 0.39, organic matter 11.39, calcium oxide 30.36, magnesia 0.56, iron oxide 4.15, alumina 0.25, carbon dioxide 2.04, phosphoric anhydride 27.37, sulphur trioxide 0.20, silica 2.23

When subjected to a comparative citric-acid solubility test, Walpole Island phosphate compared favourably with other phosphates, the order being as follows: Ephos, Walpole, Nauru, Australian

W. S. G.

8. The Preparation and Chemical Nature of Calcined Phosphate.

GUERNSEY, E. W. & YEE, J. Y. (Fixed Nitrogen Research Laboratory, Washington, D. C.). *Industrial and Engineering Chemistry*, Vol. 16, No. 3, pp. 228-232. Washington, D. C., 1924.

Calcined phosphate is prepared by heating to a high temperature a mixture of natural phosphate, an alkaline salt and carbon or some carbonaceous matter.

The authors point out that within the last 30 years numerous patents in connection with this preparation have been taken out. All these patents are, substantially, very similar to one another; the only differences are in the various proportions in which the raw materials are used and in the " modus operandi " of the various processes.

The product obtained, if well prepared, contains 25 to 30 % of P_2O_5, of which only a small part is soluble in water, whereas the greater part (85-90 %) is soluble in ammonium citrate solution. It is a dry, powdery substance with a slightly alkaline reaction, and may be stored for a long time without alteration. This substance possesses the great advantage over acid phosphate that it can be used in a fertilising mixture with calcium cyanamide without reacting with the latter.

The bibliography contains descriptions of the numerous patents in connection with this preparation, but there is nothing regarding the investigation of the best conditions for effecting the optimum conversion of the insoluble phosphorus in the phosphorite into phosphorus soluble in ammonium citrate. This forms the subject of these investigations. The tests have been made in a small rotary furnace, attention being paid to the principal factors which influence the reaction such as temperature, composition of the charge, and duration of the heating period.

From the various graphs given by the authors the most favourable conditions can be deduced for producing calcined phosphate. The optimum temperature naturally varies according to the composition of the charge. If sodium sulphate be used (the salt most commonly used on account of its low price) the most suitable charge is the following: mineral phosphate 100 parts, sodium sulphate (as Na_2SO_4) 15 parts, powdered carbon 15 parts; if it is desired to avoid the formation of powder a small quantity of water may be added, but it is not advisable to use more than 15 %. On heating this charge for 25-30 minutes at 1300°C., about 90 % of the phosphorus contained in the mineral is converted into phosphorus soluble in ammonium citrate. If on the other hand acid sodium sulphate be used (a by-product obtained in the preparation of nitric acid), the best charge is the following: mineral phosphate 100 parts, acid sodium sulphate or bisulphate 10 parts (estimated as Na_2SO_4), powdered carbon 15 parts. If this charge be heated to 1300°C. for 25-30 minutes, 80 % of the mineral phosphate is converted.

The authors then tried to discover the determining causes of the conversion of insoluble phosphate into phosphate soluble in ammonium citrate.

The quantity of sodium salt generally used for the conversion is so small that it cannot be concluded that the conversion is entirely due to the

formation of a calcium-sodium phosphate of similar composition to the acid phosphate, of the probable formula $CaNaPO_4$. This was confirmed by the chemical analysis of the product. The calcined phosphate in fact always contains a minute percentage of sodium.

The authors tried to explain the conversion by the hypothesis that it is due to the decomposition of the physical structure of the rock, probably beginning by the formation of a small quantity of calcium sodium phosphate. The note concludes with some observations of a commercial character. Basing on their practical tests, the authors consider the manufacture of calcined phosphate on a large scale to be possible. This manufacture, besides having economic advantages over that of acid phosphate, might permit of the use of phosphorites which contain much iron and aluminium. The chief commercial advantage of calcined phosphate, however, is that of being able to enter into fertilising mixtures with substances of a basic nature, such as calcium cyanamid. L. M.

9. **Manufacture of Phosphoric Acid by the Volatilisation Process.**

WAGGAMAN, W. H. (Bureau of Soils, U. S. Department of Agriculture, Washington, D. C.). *Industrial and Engineering Chemistry*, Vol. 16, No. 2, pp. 176-179, figs. 8. Washington, D. C., 1924.

The author points out that the manufacture of phosphoric acid by the volatilisation process is now a commercial process having many advantages over the old method of preparation with sulphuric acid. He foresees that very soon, when some investigations and researches on the question have been completed, it may be extended also to the preparation of phosphatic fertilisers. Whether fuel or electric energy be used to generate heat in this method of making phosphoric acid, it has three distinct advantages over the old system: 1) low grade phosphates may be used; 2) by using the modern electric precipitators to collect the volatilised phosphoric acid, a concentrated product is obtained by direct means without having recourse to costly filtrations and evaporations; 3) the cost of the necessary fuel or electric energy is always less than that of the sulphuric acid required by the old method.

In the ordinary furnaces the volatilisation of phosphoric acid takes place as in the electric arc furnaces, but the loss of heat by radiation, etc., is less with the use of the electric furnace.

It is very important in this work to ascertain what temperature is most suitable for the complete volatilisation of a mixture of rock phosphate, silica and carbon. Though much work has been done in this direction, it cannot be said that the problem has yet been solved. The minimum temperature necessary has not yet been ascertained with certainty. This indeed depends on many factors: on the relation existing between silica and lime in the charge, on the fineness of the subdivision of the material and therefore on the more or less close contact of the reacting substances, on the quantity of carbon or other reducing substance present, and on the time factor and the type of furnace used.

The investigation is especially interesting as regards common furnaces

for in electric furnaces it is most difficult to work at a lower temperature than that of the fusion of the mixture.

From the laboratory work done by the author it was noted that to obtain a good yield, a rather high temperature is necessary (1500-1600°C.).

Another problem considered by the author was to find the minimum P_2O_5 content of the slag, necessary to ensure an economically profitable production. If desired, the P_2O_5 of the slag may be almost completely eliminated, but the operation must be prolonged and, consequently, such a quantity of heat energy be consumed that, generally, the process is not very economical. It is well therefore not to carry this too far, the more so as the greater part of the phosphoric acid present is volatilised fairly quickly in the process.

Finally, the author observes that many important problems are connected with this system, for instance, the possible commercial utilisation of the slag (residuum remaining in the furnace). It addition, the effects caused by the high temperature, the phosphoric acid and other volatilisation products on the heat-resistent material and metallic constructional parts of the machinery, should be investigated. L. M.

10. **The Manufacture of Phosphoric Acid by the Volatilization Process.**

WAGGAMAN, W. H., EASTERWOOD, H. W. and TURLEY, T. B. *United States Department of Agriculture, Depart. Bulletin* No. 1179, pp. 53, figs. 12, photos II. Washington, D. C., 1924.

An experimental investigation, carried out in a strictly scientific way, and with a view to its industrial application, showed that it is possible in furnaces to drive off practically all the phosphoric anhydride from mineral phosphates. From the point of view of its industrial application, the process appears less costly than that of sulphuric acid, or the electric oven. The authors predict its industrial application. A. F.

11. **Errors in the Analysis of Double Superphosphates.**

LARISON, E. L. (Anaconda Copper Mining Co.) *Journal of the Association of Official Agricultural Chemists*, V, VII, No. 4, pp. 394-400. Washington, D. C., 1924.

The author's investigations, directed to eliminating possible causes of error in the analysis of superphosphates, originated from the following fact: in the purchase of a quantity of double superphosphate there was a difference in the seller's and buyer's analytical results and expert opinion had to be called in to settle the question. Even in the latter however there were notable differences. Samples of the material were then sent to 33 different chemists, who showed the following differences: for total P_2O_5, 1.81, insoluble P_2O_5, 0.64, available P_2O_5, 1.59, moisture, 2.45. The differences are the more notable in that all the chemists had used the United States official method. To discover the reason of such differences, the author examined every stage of the analysis. It is necessary above all to adhere scrupulously to the rules laid down for the preparation of the sample. The material should be reduced as soon as possible to a

degree of fineness sufficient to pass through a sieve with circular holes of 1 mm. in diameter ; from this the material for the weighings should be taken. Some chemists, not satisfied with the fineness of the material, pound it in a mortar, whereupon the exposure to the air and to the rise in temperature in consequence of the pounding alters the water content. Further, as there is always a little free phosphoric acid, the latter adheres to parts of the pounded material, which cannot be reduced to powder, so that the composition of the material is no longer comparable with that which passes easily through the sieve.

The principal errors are in the determination of moisture, and are caused by exposing the sample to the air before or during the determination and in not adhering strictly to the instructions to keep the material in the oven at the temperature of boiling water.

A further pounding will obviously cause fresh errors.

Another cause of error lies in the fact that the official instructions for determining the total phosphoric anhydride, after having prescribed the dissolving of the magnesia-ammonia phosphate precipitate in hot water, state that it should be nearly neutralized with hydrochloric acid. Now, it may happen that this approximate neutralization leaves the action neutral, or slightly acid or alkaline. The differences are not small, for they may be as much as 1.36. To avoid this error also, the author advises that the solution be neutralized after cooling with hydrochloric acid, using litmus for testing and then adding 1 cc. of hydrochloric acid of s. g. 1.18.

A. F.

12. **Potash from Kelp.**

TURRENTINE, J. W. and TANNER, H. C. (Bureau of Soils, Washington, D. C., and University of Oregon, Eugene, Ore). *Industrial and Engineering Chemistry*, Vol. 16, No. 3, pp. 242-284. Washington, D. C., 1924.

In this note, which is to be considered as a supplement to a series of articles on the same question, the authors describe, with detailed calculations, the theoretical investigation on which is based the separation of potassium chloride from sodium chloride in treating the brine. The separation of these two salts, which form the essential constituents of brine obtained after treatment of the kelp, is effected by alternate evaporation and cooling. From the theoretical investigation, illustrated by numerous graphs, as described by the authors, it will be seen how an exact estimation can be made of the concentration and composition of the various liquids, and also the determination of the best conditions under which the various operations should be carried out in the evaporator and vacuum crystalliser.

L. M.

13. **Field Crop Response to the Ingredients of Potassium Salts.**

HARTWELL B. L., DAMON S. C., CRANDALL F. K. *Journal of the American Society of Agronomy*, Vol. XVI, No. 10, p. 660-665. Geneva, N. Y., 1924.

Under certain conditions carriers of potassium, as well as of the other two fertiliser elements, may have marked crop effects other than

those caused by the fertiliser elements themselves serving directly as nutrients.

In the authors' experiments, magnesium potassium sulphate, potassium chloride, potassium sulphate and kainit were used under such conditions that not only the potassium, but also the other ingredients should have an opportunity to exert on the crop any effect of which they might be capable.

For ten years, the basal fertiliser common to all the experiment plots was composed of materials not containing potassium, sodium, magnesium, sulphur or chlorine. These elements were added in one or more of the commercial potassium salts, and comparisons made with the no-potassium plot. On the control plot there was no apparent deficiency of potassium until 1918.

During the last five years, if the average percentage increase due to the magnesium-potassium sulphate is taken as 100, sulphate of potash equals 109, chloride of potash 113, and kainit equals 135.

Sodium is useful when potassium is insufficient, and the superiority of the kainit was no doubt due to its containing about twice as much soda as potash.

If sulphur had any effect, it was apparently less than that exerted by the sodium; magnesium was evidently not deficient. W. S. G.

14. The Fixation of Nitrogen as Cyanide.

FRANCHOT, R. (Ferro Chemicals Inc., Washington, D. C.). *Industrial and Engineering Chemistry*, Vol. 16, No. 3, p. 235-238. Washington, D. C., 1924.

The problem of the fixation of atmospheric nitrogen by an economic process is of great importance to agriculture on account of the so-called « nitrogen cycle », i. e. the possibility of returning to the soil all the nitrogen extracted therefrom by the various crops.

The author points out that since 1840, when it was discovered that cyanide is formed by heating to a high temperature alkali and carbon in the presence of nitrogen, many tests have been made in order to find out whether this reaction cannot be utilised so as to render possible an industrial process for fixing nitrogen. There have always been serious difficulties however in the way of industrialising the process which until a short time ago appeared to be insurmountable.

The greatest difficulty encountered by POSSO and BOISSIÈRE in 1847 and BUCHER in 1917, was, in making use of a retort heated externally, to apply the amount of calories necessary for the reaction, which is highly endothermic and requires an enormous calorific energy and an extremely high temperature. In the second place, there were heavy losses of alkali through volatilization.

By employing modern processes in which the heating is done by electric means, and the cyanide, in vapour form, is expelled from the formation zone, it seems that the first and most serious difficulty can be surmounted; but leaving out of account the high cost of electric energy,

[14]

these processes also possess great disadvantages. First of all the difficulty of condensing and separating the cyanide from the other secondary gaseous products present, then the difficulty of avoiding the reversibility of the reaction, whereby the cyanide formed decomposes again into alkali, carbon and nitrogen, at a temperature very near that used in the formation.

The most promising method, with a view to commercial application, is based on the principle of uniting the exothermic reaction of carbon oxidization with the endothermic reaction of the formation of cyanide by making use of a mixture of nitrogen and oxygen or simply of air.

The author illustrates and discusses in detail some very recent patents based on the above principle. These processes are very promising and meet with authoritative confirmation, as the author points out in the repeatedly observed formation of cyanide in blast furnaces, where the air or gas in the generators comes into contact with carbon and alkali at a temperature of about 1500°C. The author, who recently had occasion to determine the percentage of cyanide present in blast-furnace gases, makes some interesting observations. Among other things he observes that in the United States of America the blast furnaces have a total capacity of 40 million tons of soft iron and fix about 6 million tons of nitrogen per year.

This is about double the quantity of nitrogen calculated to be absorbed by the various crops on the whole of the territory of the United States under cultivation. L. M.

15. Utilisation of Nitrogen in Soils and Fertilisers as Affected by Lime.

LIPMAN, J. G., and BLAIR, A. W. (New Jersey Agricultural Experiment Station, New Brunswick, N. J.). *Industrial and Engineering Chemistry*, Vol. 16, No. 4, pp. 373-375. Washington, C. D., 1924.

This report contains the results of a series of investigations commenced as far back as 1898, which consist of tests made in small cylinders exposed to the air, and therefore under normal conditions, with the object of examining some phases of nitrate fertilisation. The following were used as fertilisers: nitrate of soda, ammonium sulphate, dried blood and stable manure and mixtures of nitrate and stable manure, ammonium sulphate and stable manure, dried blood and stable manure. In a first period of 10 years, the tests, which were all made in triplicate, were carried on by giving to all alike, lime in the same proportions. At the beginning of the second period of 10 years, the various cylinders containing the samples were divided into three groups, *a*, *b* and *c*. To the cylinders in the first group the various nitrate fertilisers were added and no lime; to the second group were added the usual nitrate fertilisers and lime at intervals of 5 years; those in the third group received, in addition to the nitrate fertilisers and lime (applied in the same way as for group *b*), nitrogen by means of a legume crops, twice in a period of 5 years.

The chief problems examined, in these numerous series of tests, were the following: 1) Available nitrogen in the various nitrogenous products

in use, either alone or mixed with stable manure. 2) Ascertaining whether denitrification takes place when they are used in combination with nitrate of soda and stable manure in the usual annual proportions. 3) Determination of the influence of the various nitrate treatments on the proportion of nitrogen in the crop. 4) Ascertaining the extent of the loss or gain in nitrogen by the soil contained in the cylinders after the various treatments.

In this note the authors however only give a part of the data collected in these numerous tests. From these data it may be concluded that the continued use of ammonium sulphate, without lime, causes a strong acidity of the soil, so strong as to practically prevent plant growth. In the group *b* tests, on the other hand, results show that by the application of ammonium sulphate, with lime, the crops are normal. Stable manure tends to correct the injury caused by the continuous use of ammonium sulphate without lime. It was then found that, in a normal soil, denitrification does not take place when nitrate of soda is used with the right proportion of stable manure. By the use of nitrate of soda mixed with stable manure production is maintained at a high level, the increase obtained with this mixed fertiliser being often greater than the sum of the increases obtained with the two fertilisers used separately.

The same was also true in the case of mixtures of stable manure and ammonium sulphate, stable manure and dried blood and finally, in a lesser degree, in the group of cylinders to which lime was not administered. The increase of nitrogen in the various crops by using the mixed fertiliser (stable manure and one of the nitrogenous products on the market) was generally equal to or greater than, the sum of the amount recovered by using the same fertilisers separately. The percentage of nitrogen found in the dry material is, in many cases, influenced by the nitrogenous material used, and also by the presence or absence of lime, also by the fact that legume crops have or have not been introduced in the rotation of the crops.

The total quantity of nitrogen in the crop then depends entirely on the treatment with lime and on the green leguminous crop in the presence of lime. L. M.

16. **Available Nitrogen in Fertilisers.**

KELLOG, J. W. (Bureau of Chemistry, Pennsylvania Department of Agriculture, Harrisburg, Pa). *Industrial and Engineering Chemistry*, Vol. 26, No. 4, pp. 371-372. Washington, D. C., 1924.

The author points out that the problem of determining the percentage of available nitrogen in the various fertilisers placed on the market has been for many years an object of investigation on the part of those interested in agricultural chemistry. A practical method was sought for its determination, such as already exists in the case of water-soluble P_2O_5 and K_2O. As the methods in use do not always give concordant results, they do not solve the problem because they only give the percentage of insoluble organic nitrogen and not the total percentage of available nitrogen.

In this connection the author points out that at the meeting of the

Agricultural Departments held at New York in 1921 the advantage of investigating and establishing the form of a new method for determining the available nitrogen was discussed, as the methods with permanganate are not satisfactory and often lead to errors and confusion. The principal object of the author is to again call the attention of investigators to the subject and to show what requirements a new method should satisfy, in order to admit of profitable application.

The new method should require a single weighing of the sample and a single determination of nitrogen in addition to that of the total nitrogen, as this would save time and expense in the estimation. Further, there is need of a means, after having extracted the water-soluble nitrogen, to attack, reduce and dissolve that portion of nitrogen in the organic matter which, from determinations made by pot or field tests, must be considered as available. In other words, it should be possible to separate not only the greater percentage of available nitrogen in the ammonia compounds, but also should attack only a comparatively small portion of the nitrogen in those compounds, which must be considered to be low in available nitrogen. And finally, it should be possible to determine the non-available nitrogen.

The author has successfully used oxalic acid in a very diluted solution, as a means for attacking the organic substance in a fertiliser, in order to obtain in solution the nitrogen contained therein; the tests made show that the oxalic acid solution best adapted to this purpose is 0.01 N.

The method suggested consists in the treatment of 1 gm. of the fertiliser, first with repeated applications of distilled water (at room temperature) in order to remove the water-soluble nitrogen, then, after heating, with 100 cc. of 0.01 N. solution of oxalic acid, in order to remove the organic nitrogen, the non-available nitrogen in the residue is determined as usual by the Kjeldal method. Finally, deducting the value obtained from the total nitrogen already determined, the percentage of available nitrogen is obtained. L. M.

17. **Sources of Ammonia in Potato Fertilizers.**

LIPMAN, Dr. J. G. (Director, State Agricultural Research Station, New Jersey). *Bulletin* 39, pp. 171-177. The State Potato Association, Trenton, State of New Jersey, U. S. A., 1924.

The sources of fertiliser ammonia are classified under three heads, namely, ammonia from nitrates, ammonium salts and from organic sources. Ammonia compounds come largely from two sources: sulphate of ammonia and so-called base goods, the latter being produced when lower grade animal products are treated with acid in making acid phosphate. A large proportion of the ammonia in mixed fertiliser is derived from base goods.

In addition to true organic sources, such as tankage, fish and cotton seed meal, ammonia is also derived from cyanamide and in the future "urea" will doubtless play an increasing part.

In mixtures, more than one source is employed, as by so doing a

more continuous supply of ammonia is given to the plant and the fertiliser is safer in use, especially from the standpoint of acidity, as the source has a great deal to do with soil acidity.

The degree of soil acidity is important in the prevention of scab, and other things being equal, only such fertilisers should be used as will reduce the danger from scab.

As regards cost, it is obvious that organic ammoniates are expensive and should be cut down, unless they are more efficient than other sources, and at best the efficiency of animal products is no greater than that of chemical carriers of ammonia.

Nitrate of soda will tend to make the soil less acid, whereas sulphate of ammonia increases acidity and where scab is prevalent the latter is the better source of ammonia. Bone meal, tankage, fish, basic slag and cotton seed meal will also have a tendency to make soil less acid, whereas chloride or sulphate of potash, acid phosphate, sulphate of ammonia and other ammonia salts will have the opposite reaction. Where the grower is confronted with a bad scab problem and drastic treatment is necessary, sulphur is the best remedy.

When the condition of the soil is such that scab is no longer troublesome, it is better to use a combination of fertilisers, in order to maintain the soil at the same degree of acidity. There is danger in the continued use of fertilisers such as would ultimately make the soil too acid to obtain a good crop. It is important to avoid dependence on acid fertilisers which in time would lead to undue accumulation of acidity in the soil, beyond the point where our particular problem is met.

W. S. G.

18. **The Value of Sulphur in Soil Improvement and Crop Production** (1).

LIPMAN, J. G. (New Jersey Experiment Station, New Brunswick, N. J.). *Industrial and Engineering Chemistry*, Vol. 16, No. 3, pp. 250-252. Washington, D. C., 1924.

The author first points out that sulphur and the compounds containing it are daily applied on a vast scale in all fields, and especially in that of agriculture. Besides furnishing the supplementary portion of the element of sulphur, necessary for plant nutrition, when it is not found in sufficient quantities in the soil in an assimilable form, it imparts such acidity to the soil as to prevent the growth of certain fungi and especially of certain organisms which cause serious plant diseases, such, for instance, as potato scab. Sulphur may also be used to correct the undesirable conditions of an alkali soil, to suppress and eliminate insects infesting the soil and to eradicate weeds.

In this note the author gives some data representing the result of numerous tests made by him, over a period of several years, in collaboration with other investigators, with the object of examining and controlling potato scab. These data show that the efficacy of flowers of sulphur sold on

(1) See *R.* 1924, No. 593. (*Ed.*)

the market, is in direct ratio with its degree of fineness. Indeed, among the various qualities used in the tests, the finest (passed through a 200-mesh sieve) was in every case the most effective.

The results of certain tests are then given, in which, still with a view to the treatment for potato scab, sulphur was administered together with the usual fertilising nitrates, that is, ammonium sulphate and nitrate of soda.

The best results were obtained with ammonium sulphate. The sulphur mixed with an equal quantity of ground natural phosphate, gave excellent results, superior to those obtained with sulphur alone. But besides these concrete results, the tests made by the author and his collaborators have shown the tendancy, more or less evident but always observable, to an increased yield in the crops when sulphur was used against scab. It seems then that, under determined conditions and in conjunction with other factors, sulphur has a stimulating effect on the growth of potatoes, tomatoes and perhaps also on other crops. L. M.

Agricultural Botany.

19. Evolution of Botanical Agronomical Formations in the Western Congo.

VANDERIST, H. L'évolution des formations botanico-agronomiques dans le Congo Occidental. *Revue des questions scientifiques*, Series IV, V. 6, No. 1, pp. 65-82, Louvain, Paris, 1924.

It may be concluded that towards the end of the tertiary epoch Central Africa, especially the Congo basin, already possessed the conformation and topography of the present time. The flora and fauna, from the beginning of the quarternary epoch have not become richer, some plants even have become extinct, while other have migrated, in consequence of climatic conditions. The latter have not remained constant, particularly as regards the prevalence of rains, which have been diminishing, while dry-season periods have been establishing themselves. It will be understood therefore that the geo-botanical conditions have also changed.

From these observations therefore, four geo-botanical periods may be established.

1) *Primitive.* — Before the advent of man, the abundant rains were favourable to forest extension. Many formations, especially the steppes, were richer in woody plants and contained more trees than the corresponding formations at present.

2) *Prehistoric.* — Contemporaneous with the Negrilles, prehistoric, savage non-agricultural peoples, living only on game, fish and the fruits which they gathered. They burnt certain formations, whence the flora and fauna came to be modified, becoming more and more barren. These modifications afterwards continued owing to the prevalent habit of burning the grass.

3) *Steppe formations.* — With the arrival of the Bantus in the Western Congo, the periodical cultivation of the barren sparsely treed

steppes favoured their gradual transformation into forest formations, which in turn were used for agricultural purposes. These secondary forest formations also became transformed into palm plantations where the microbiological soil conditions were more favourable.

4) *Modern denudation of forests.* — Denudation began with the European occupation of the Congo and is characterised by the destruction of the forest formations. It may also be termed the period of empiric culture, or gradual destruction of forests. This destruction is a consequence, not of the burning of the grass, but of the abandonment of the Bantu system of cultivation.

The consequence of this period, the inconveniences of the "Raubkultur", which is still in its initial stage, make themselves felt at present, only near the great centres. They nevertheless involve a serious question of agronomical economy, which requires attention on the part of the public authorities. A. F.

20. Serodiagnostic Investigations on Affinity between Various Dicotyledons.

RAEDER, F. Sero-diagnostische Untersuchungen über strittige Verwandtschafts Verhältnisse innerhalb der Dikotylen. *Botanisches Archiv.* Vol. VII, Nos. 1-2, pp. 9-10. Dahlem (Berlin), 1924.

The object of these investigations was to determine the affinity of the albumen with the help of sero-diagnosis.

The Author first states that his test method differs from that of his predecessors in that, whereas the latter limit their material to the seeds of the plants, he utilises the whole plant, and thereby succeeds in proving what had already been recognised with regard to the seeds, and that is that the plants in a fresh state impart a greater quantity of albumen to the solvents than those gathered some time previously.

As a decisive proof that it is better to test with the whole plant, the Author cites the case of *Hypericum*, from the seeds of which it was impossible to extract any traces of albumen, even with sodium hydrate, whereas this was rendered possible by treating the whole plant with hydrochloric acid.

It is also notable that albumen extracted from a plant recently gathered shows stronger reaction than in the case of dried plants.

The special investigations of the Author chiefly concern *Adoxa moscatellina*, *Polygala vulgaris*, *Arctostaphylos Uva-Ursi*, *Empetrum nigrum*, *Hypericum perforatum* and *Viscum album*.

As regards *Adoxa*, the positive reactions obtained by the Author clearly show the close affinity of *Adoxa* with *Caprifoliaceae*, *Dipsacaceae* and *Rubiaceae*; with other families results are still doubtful. *Ericaceae*, *Celastraceae*, *Meliaceae*, *Buxaceae* and *Hippocastanaceae* are shown to be related in affinity to *Polygala vulgaris*. In the case of *Arctostaphylos Uva-Ursi* distinctly positive results were obtained with *Ericaceae*, *Celacaceae*, *Polygalaceae*, *Vitaceae Rhamnaceae*, and *Sapindaceae*; less marked positive reactions were obtained with a great number of other plants.

Empetrum nigrum showed a close affinity with *Polygalaceae*, *Ericaceae*, *Celastraceae*, *Rhamnaceae* and *Vitaceae*, and less affinity with other families of plants.

Hypericum perforatum showed affinity with *Hypericaceae*, *Theaceae*, *Cistaceae* and *Buxaceae*. Finally, tests on *Viscum album* showed its decided affinity with *Polygonaceae*, *Myricaceae*, *Betulaceae* and *Juglandaceae* and a less marked affinity with numerous other families. G. B.

21. **Simple Contrivance for Studying Root Development.**

VENKATRAMAN, Rao Saheb T. S. (Government Sugarcane Expert, Coimbatore) and THOMAS, R. *Agricultural Journal of India*, Vol. XIX, Part 5, pp. 509-514, plates 4, figs. 11. Calcutta and London, 1924.

In order to study root development, especially of agricultural crops, the authors devised a method which has been found useful in the investigation of the roots of sugarcane seedlings, but is equally applicable to other plants

The apparatus consists of rings of earthenware one foot six inches in diameter and six inches high. Galvanized wire netting of two-inch mesh is cut into squares about three inches larger than the diameter of the earthenware rings.

A trench is dug in the soil a little over the maximum depth of the roots of the plant which it is intended to study. At the bottom of the trench an earthenware ring is placed and is filled with soil, on which is then laid a square of wire netting. A second ring is placed on the first, filled with soil, and on this also is put a piece of netting, the process being repeated until the rings are level with the top of the trench.

A sett of the cane variety under study is fastened to the netting on the topmost ring, or is fixed to a wire stretched across it. The trenches containing these columns of rings are filled in with soil and are then cultivated and irrigated in the usual way.

To examine the root system, when grown, the soil round the rings is dug out, planks are inserted under the lowest ring and the column is lifted out of the trench. The soil is washed out by means of a stream of water. The column is then placed inside a wooden frame to which the edges of the wire netting are fastened. The rings may now be removed with little difficulty, when the whole root system of the plant will be found fully exposed, with the roots held in the position which they occupied in the soil.

The method is efficient, and after fixing to the frame the root system of a plant may be easily photographed, an important point for the accurate recording of root development at successive stages. W. S. G.

22. **Deciduous Tree Stocks with Special Reference to their Identification.**

HEPPNER, M. J., *University of California, Agricultural Experiment Station, Technical Paper* No. 6 pp. 25, plates 6, table, bibliography. Berkeley, Ca., 1923.

An investigation was made with two objects in view: — (1) to determine whether the distinctive morphological differences existing between

common rootstocks used for propagation of deciduous fruits in California, may be used as a means of identification of species, when only a portion of the root system is available ; (2) to differentiate between the various kinds of stocks on the basis of microscopic anatomical study of the root structure.

The following includes all the root stocks employed :—

Prunus :— *P. Armeniaca* ; *P. Persica* ; *P. Amygdalus* ; *P. cerasifera* ; *P. Avium* ; *P. Mahaleb* ; *P. Davidiana*.

Pyrus :— *P. serotina* ; *P. communis* ; *P. ussuriensis* ; *P. Calleryana* ; *P. Malus*.

Cydonia :— *C. oblonga* var. *Orange* ; *C. oblonga* var. *Angus*.

The records made in the field and in the laboratory, described in detail by the author, have led to the following conclusions : (*a*) Ecological variations cause marked differences in certain morphological and anatomical characteristics of roots stocks, this being more marked on the *Pyrus* stocks compared with *Prunus* ; (*b*) *Pyrus* roots may be definitely separated from *Prunus* by a histological study of the following : medullary rays, shape of tracheae in cross-section, and nature of heart and sap wood ; (*c*) *Prunus Amygdalus* may be distinguished by character of lenticels, *Prunus Persica* and *Prunus Davidiana* although identical morphologically, differ as regards formation of tracheae, the former are distinguishable singly and the latter in groups. *Prunus cerasifera* demands a special study of medullary ray cells and heart and sap wood. *Prunus Mahaleb* and *Prunus Avium* are analogous morphologically, but are strikingly different histologically and the latter is readily identified by the astringent taste ; (*d*) Colour should not be used to identify *Prunus* stocks except in the case of *Prunus Armeniaca* with its beet-red roots ; (*e*) *Pyrus* species are less easily distinguished, but the chief characteristic of *Pyrus Malus* is the large loosely fitting cells that make up the cortex ; (*f*) *Cydonia* roots are practically identical with *Pyrus*, both morphologically and histologically, the only noticeable difference being the wider thickness of the *Pyrus lumina* of the wood fibres ; (*g*) *Pyrus serotina* may be distinguished from *Pyrus communis* by the study of the tracheae in the spring wood of each year, the former being less angular-walled and elongated radially.

M. L. Y.

23. Anatomy of the Root and Stem Formation of the Rape and Turnip.

SOEDING, H. Anatomie der Wurzel- Stengel- und Rübenbildung von Oelraps und Steckrübe (*Brassica Napus* L; var. *oleifera* und var. *Napobrassica*). *Botanisches Archiv*. Vol. VII, parts 1-2, pp. 41-69. Königsberg, 1924.

The object of the Author's anatomical investigations is to determine whether clear and essential differences exist between the two varieties of plants named or whether such differences are merely in degree. The first question which arises in this kind of investigation, seeing that it was impossible to trace any appreciable differences between the seeds of either plant, is to determine whether such differences can be traced in the seedlings or at least in their first stage of growth. In other words, it must be determined which characteristics common to either plant continue as such until

the plant has attained its full development, and which characteristics undergo a process of differentiation, and then it must be determined in what stage of growth such differentiation commences.

Investigations made on both varieties of plants, one week old, have shown that no anatomical difference can be found in them. The same result was obtained also with plants aged two and also four weeks. Only towards the age of six weeks can an initial differentiation in the two plants be noticed. These differences are: in the arrangement of the adventitious roots; in the greater or lesser degree of wood-formation of the xylem; and finally with regard to the phloem at the pith stage.

As is known, the adult rape possesses adventitious roots placed in two more or less regular lines; the turnip on the other hand, shows a lesser number of adventitious roots in various stages of growth.

Another peculiarity which distinguishes the turnip is the fact that the absence of the xylemprosenchyma with thick walls in the upper part of the hypocotile, must be attributed to a lesser aptitude on the part of the turnip to form thick xylem walls.

The rape has a well-developed root and stem, whereas the turnip springs from the root and hypocotyl, showing a tendency to form tissue and thin walls. Finally, as a greater quantity of phloem in the woody state is found in the adult turnip than in the rape, it is deduced that the aptitude to form phloem at the pith stage is greater in the turnip than in the rape.

In the later development of the two plants, the anomalies observed in the growth of the turnip may be summarised as follows:

(1) the xylemparenchyma of the central part of the plant, originating from the xylemprosenchyma; (2) leading concentric fibres at the xylem stage, with internal phloem; (3) concentric tissues at the xylem stage, with internal xylem; (4) phloem at the pith stage; (5) extraordinary development of the thickness of the pith, due to the subdivision of the cells.

In the rape No. (1) anomaly is less accentuated than in the turnip. No. (2) anomaly is rarely met with in the rape. No. (3) anomaly is also found in the rape. In the latter, phloem is also found in the pith stage. By cutting a section of the upper part of the hypocotyl, anomaly No. (5) may be observed, as in the beet. B. G.

24. Studies on the Potato Tuber.

ARTSCHWAGER, E. (Bureau of Plant Industry. United States Dept. of Agriculture). *Journal of Agricultural Research*, Vol. XXVIII, No. 11, pp. 809-835, figs. 8, bibliography. Washington, D. C., 1924.

A detailed study of the structure and development of the potato tuber, with comprehensive diagrams and illustrations which should facilitate to a certain extent the grouping of varieties, although it is indicated that the presence or absence of cells hardened by secondary deposits, the components of sclerogen, is the only definite character which can be used satisfactorily in classification.

As regards the chemical constitution of the tuber, a thorough study

has been made and the protein crystals, the tannin vesicles and the solanin are considered of special interest. The accumulation of solanin is encouraged by delayed germination. M. L. Y.

25. **Investigations on the Presence of Iodine in Nature.**

FELLENBERG, TH. v. (Labor des eingenossischen Gesundheitsamtes in Bern). Bestimmungen kleinster Jodmengen. *Biochemische Zeitschrift*, Vol. 152, pts. I & II, pp. 116-127. Berlin, 1924.

Idem. Jodbestimmungen in Lebensmitteln, Düngemitteln, schweizerischen Mineralwassern. *Ibidem*, pp. 128-131.

Idem. Über das Entweichen von elementarem Jod aus Meerwassern. *Ibidem.* pp. 132-134.

Idem. Üntersuchungen über den Jodgehalt der Luft., pp. 135-140.

Idem. Über den Zusammenhang zwischen der Haufigkeit des Auftretens von Kropf und dem Jodegehalt der Umwelt. *Ibidem*, pp. 141-152.

Idem. Über den Jodegehalt der Gesteine, der Geologischen Formation und der Mineralien und über die Bedingungen der Jodanreicherung in Erden. *Ibidem*, pp. 152-171.

Idem. GEILINGER, H. and SCHWEIZER, K. Üeber das Freiwerden elementaren Jods aus Erde. *Ibidem*, pp. 172-184.

FELLENBERG, TH. v. and GEILINGER, H. Ueber Jodabspaltung und Jodspeicherung durch Mikroorganismen. *Ibidem*, pp. 185-190.

From the works mentioned, omitting the description of the technical means adopted, the following conclusions may be drawn: Iodine is found in varying quantities in different substances. Calculated in millionths of a gram, it is found in wheat in quantities of 26-24, in ground-nuts, 200, in cod-liver-oil, 5640, in milk chocolate, 140, in liver-wort, 310 and in valerian 232.

As regards chemical fertilisers, there are 5700 in superphosphate, 192,000 in nitrate of soda and 440 in kainit.

As regards Swiss mineral waters, there are 1005 in Fortunatusquelle (Passug) and 6310 in Wildegger Jodwasser.

In sea-water there are 13-17 per litre ; and it is given off by the water itself in more or less large quantities (from 2 to 8 % in about 20 days). Under natural conditions a larger quantity must be given off, and is then returned to the soil in the rain.

There are notable fluctuations in the iodine content of the air. On dewy nights a considerable quantity is dissolved in the dew, from which it evaporates into the air, where it is at its maximum in the morning and begins to diminish towards midday. The quantity of iodine is greater in the lower strata of the air than at the height of a man and tends to diminish in a vertical direction.

There is a considerable quantity of iodine in primitive geological and sedimentary formations, where it is found in an insoluble form, but is soluble in acids ; the latter form is most important for plants.

There is no relation between geological formation and iodine content ; sometimes, even among chemically similar minerals, there is a difference in iodine content. The iodine may be in various combinations ; in some

heavy minerals it may be present as insoluble iodine, in others, especially among the allanites, it is in complex combination.

The rocks increase their iodine content under the influence of meteorological conditions, soils originating from the meteorological decomposition of rocks become still richer. Acid rocks and soils absorb more iodine ions than basic soils and rocks. From decayed, dead, vegetable matter, organically combined iodine is eliminated very slowly. Soils and rocks act as catalysers, setting free the iodine; rocks containing ferric-oxide have the greatest influence, those containing ferrous-oxide the least. In the presence of the smallest quantities of iron, the catalysing action is stronger in proportion as the hydrogen-ion concentration is greater.

The presence of microorganisms (bacteria and moulds) decreases or obstructs the elimination of iodine by alkaline iodine solutions because the iodine which is set free becomes fixed by the microorganisms themselves.

As regards the connection between the iodine content of the surroundings and goitre, the author found that in countries without goitre the largest quantity of iodine existed in the air, drinking water, rocks, soils, milk and eggs; the smallest quantity on the other hand was found in the cantons where goitre was prevalent. Another proof that the food-stuffs in countries without goitre were richer in iodine, lay in the fact that the urine there was richer in iodine; the quantity contained therein was greater than that which can be absorbed by the use of iodine salts, which proves the innocuity of the latter. A. F.

26. The Importance of Calcium for Plants.

PRIANISHNIKOFF, D. Zur Frage über die Bedeutung des Calciums für die Pflanze. *Berichte der deutschen botanischen Gesellschaft*, Vol. XLI, part 4, pp. 138-144, fig. 1. Berlin, 1923.

By the water culture method the Author has been able to prove that plant growth is impeded when calcium is absent; traces of disease are observed on the leaves, and the radical system shows but slight development.

As regards the antagonism between volatile acids and calcium salts, the Author has observed that by means of diluted solutions of di-valent metals (Mg, Mn, Ba, Sr, Ca) in 0.0005-0.005/N concentrations, the cell resistence to the acid is considerably increased. Calcium exerts the greatest antitoxic action. The mono-cation salts on the other hand (Na, K) in the same concentrations, exert little or no antitoxic action against the H ions. When weak solutions of salts are used, no specific action by the anions on the antitoxic effect of the salts is observed. For instance, calcium nitrate and calcium chloride have almost the same effect. A. F.

27. Daily Variation of the Carbohydrates in the Leaves of Maize and the Sorghums.

MILLER, E. C. (Plant Physiologist, Kansas Agricultural Experiment Station). *Journal of Agricultural Research*, Vol. XXVII, No. 10, pp. 785-808. Tables 10, figs. 6, bibliography. Washington, D. C., 1924.

These experiments were made in view of the probable value not only in interpreting the different behaviour of maize and sorghum when grown

under severe climatic conditions, but also in helping to gain a better general knowledge of the fundamental physiological processes of agricultural plants.

Analyses were made of material collected at 2-hour intervals from the leaves of maize, milo and sorghum grown under identical or similar field conditions. Ten sets of plants were under observation.

Results obtained permit the following conclusions:

(1) The amount of dry matter in a given area of leaf of sorghum is greater than that of maize. In both cases the percentage increased at daylight, reached a maximum from 2 to 6 p. m. and then decreased gradually until the following morning. The maximum increase for milo was about double that for maize.

(2) The leaves of maize contain a higher percentage of water than sorghum. In both cases a decrease is noticeable from midnight to 5 a. m., and a maximum from 12 midday to 3 p. m. With maize, when the minimum of 112 gm. per sq. metre of leaf water content is reached, this becomes a limiting factor in the production of dry matter. This does not apply to sorghums.

(3) The total sugars in the leaves of both plants begins to increase between 4 and 6 a. m. with a maximum from 12 midday to 5 p. m. and a decrease gradually from 5 p. m. till the following morning.

(4) The increase in the total sugars and insoluble carbohydrates in the leaves during the day only approximated from 46 to 92 % of the total increase in the dry matter of the leaves for the same period.

(5) The non-reducing sugars in the leaves are with the exception of the milo and sorghum, always in excess of the reducing sugars. The increase was noticeable during the day and the decrease at night, but the variation for reducing sugars was negligible. No significant differences were observed between maize and the sorghums as regards the relationship between reducing and non-reducing sugars in the leaves.

M. L. Y.

28. The Nutritive Properties of Wild Rice, *Zizania aquatica*.

KENNEDY, C. (Minnesota Agricultural Experiment Station). *Journal of Agricultural Research*, Vol. XXVII, No. 4, pp. 219-224, figs. 2. Washington, D. C., 1924.

Wild rice, a cereal which differs considerably from common rice, is an annual plant growing in shallow lakes and sluggish water courses over extensive tracts of country in North America.

It is used as a food by some Indian tribes in the Valley of the Upper Mississipi and also, in a restricted degree, in hotels and private houses. Wild rice likewise serves as an important food for acquatic birds. It is harvested by the Indians in a primitive way, before complete maturation, so that ripening has to be carried out artificially.

The chemical composition of wild rice as compared with that of cultivated rice, is shown in the following table:

[28]

	Moisture	Ash	Protein	Ether Extract	Cellulose	Starch	Soluble carbohydrates such as Dextrin
	%	%	%	%	%	%	%
Wild Rice . . 1)	7.74	1.09	13.36	0.455	1.39	65.26	2.98
» » . . 2)	7.85	1.38	13.97	0.893	1.41	61.69	3.69
» » . . 3)	8.93	1.17	14.62	0.718	1.94	60.47	2.35
» » . . 4)	7.83	1.25	14.40	0.658	1.29	62.03	2.95
Coarse Cultivated Rice	12.22	1.01	5.04	2.01	1.08	69.50	0.85
Polished Cultivated Rice	12.30	0.40	8.00	0.30	0.20	79.00	—

Inorganic element content as compared with that of skimmed milk powder:

	Ca.	Mg.	K.	Na.	P.	S.
	—	—	—	—	—	—
Wild Rice	0.018	0.030	0.055	0.064	0.424	0.258
Polished Cultivated Rice	0.008	0.027	0.069	0.021	0,102	0.105
Skimmed Milk Powder.	1.33	0.147	1.27	0.488	0.979	0.357

Feeding tests were also made on rats by means of the usual methods for testing deficiencies of separate feeds. The results showed that wild rice cannot be considered as an adequate feed. Although chemical analysis reveals a percentage of protein higher than that in other cereals, it seems to be of low biological value. Like other cereals, it contains insufficient inorganic matter to promote growth, and is very deficient in vitamine A, although the quantity of the latter is sufficient to prevent xerophthalmia.

Wild rice however has a higher nutritive value than polished cultivated rice because its protein contains a sufficient quantity of vitamine B to permit of animal growth, which is not the case with polished cultivated rice.

A. F.

20. **An Investigation on the Toxicity of the Lima Bean (*Phaseolus lunatus*).**

GREENSTREET, V. R. *The Malayan Agricultural Journal*, Vol. XII, No. 4, pp. 107-109. Kuala Lumpur, 1924.

The nutritive value of the Lima bean (*Phaseolus lunatus*) has fallen into disfavour owing to the prevalent idea that the bean contains a cyanegenetic glucoside of a toxic nature. An investigations has been made to ascertain the actual constitution and according to the analytical results here described the amount of hydrocyanic acid contained in the small quantity of beans consumed at one meal is negligible, and the author confirms the fact that the Lima bean is harmless.

M. L. Y.

30. The Relation of Root Growth to Oxygen Supply.

Cannon, W. A. (Coastal Laboratory, Carmel, California). *Ecology*, Vol. V, No. 4, ppl 319-321. Brooklyn, N. Y., 1924.

Among the surroundings in which plants live, there are two important factors (besides those obvious ones, soil and water), temperature and the supply of oxygen to the roots. The deficiency of oxygen is a factor which limits growth to a degree which depends on the temperature and on the species. The author therefore introduces the conception of a growth ratio being furnished by the growth value at a determined temperature and with a partial pressure of oxygen, divided by the growth obtained at the same temperature under normal aeration conditions.

The author's observations show that, with a low pressure of oxygen, the growth ratio varies with the temperature, and that when the temperature is constant, it varies with the quantity of available oxygen.

The explanation of this fact may be found in physical and physiological factors.

A. F.

31. Studies in Transpiration of Coniferous Tree Seedlings.

Pearson, G. A. (Southwestern Forest Experiment Station). *Ecology* Vol. V, No. 4, pp. 340-347, fig. 1. Brooklyn, N. Y., 1924.

The study of transpiration may furnish much information on the relations of water to trees: water consumption in relation to growth, the capacity of adaptation to scarcity of water and that of obtaining moisture from the soil.

The author's tests were made on: *Pinus scopulorum*, *P. aristata*, *Pseudotsuga taxifolia*, *Picea Engelmanni*. *Pinus aristata* shows the highest ratio between transpiration and growth, then follow *P. scopulorum*, *Pseudotsuga* and *Picea*. All the species show great resistence to transpiration when the water supply is reduced to a detrimental level; resistence to drought is also afforded by the development of the root system as shown by pot tests and under natural conditions. In the former case, the compact and fibrous root system of *Pinus* and *Pseudotsuga* gives these two species as advantage; the adaptation capacity is lower in *Pinus scopulorum*. In their natural surroundings there are other differences: 3 months after germination the roots of *Pinus scopulorum* have penetrated to a depth of 15-25 cm., while those of *Picea* have scarcely reached a third of this distance. The lateral extension depends especially on the nearness of other trees: *Picea* and *Pseudotsuga* grow close together and have a hollow, compact radical system, whereas the pines grow more sparsely and their roots go deeper and are more extended. Of all the factors which favour survival in an arid situation, the depth of root penetration during the first stages of growth is undoubtedly the most important.

A. F.

32. Photoperic [illegible] n Relation to Hydrogen-ion Concentration of the Cell Sap and the Carbohydrate Content of the Plant.

GARNER, W. W., BACON, C. W. and ALLARD, H. A. (Bureau of Plant Industry, U. S. A.) *Journal of Agricultural Research*, Vol. XXVII, No. 3, pp. 119-158, 10 figs., 2 tab., Bibl. Washington, D. C. 1924.

The length of the period of the plant's daily exposure to light has considerably influenced its development and, particularly, its flowering and fructification. There are, for instance, varieties of Soy that, in the Washington latitude flower in the middle of June, others in the middle of July or at the beginning of August or of September. When the periods of daily exposure to light are shortened, late varieties flower earlier, whereas when such period is prolonged the plants continue in a vegetative state. This type of plants, which increases in height when exposed to long daily periods but flowers quickly if exposed to shorter periods, is called short-day plants. But there is also another type which, on the other hand, if exposed to short daily periods of light, tends to develop the rosette-leaf stage, without elongating the stem, and to tuberise the root, while, if exposed to long periods, it develops the stem and flowers. This is called the long-day type. There are also intermediate types.

These facts, previously ascertained by the Authors, are now investigated by connecting them with phenomena which take place within the plant, under the influence of the various periods of exposure to light. In the case of short-day plants, the undetermined stem-growth, characteristic of long periods of exposure, is associated with the progressive increase of active acidity in the plant, especially in the part where growth takes place, until the upper parts become more acid than the lower. Exposure to shorter periods, followed by a moderate increase in height and flowering, finally diminishes, and then slightly increases, acidity, but much less than under the previous conditions. The relations between the acidity of the various parts are also changed, being greater in the lower than in the upper parts. When flowering has commenced acidity decreases. The shoot has a comparatively low acidity, which increases, attaining its maximum before budding takes place. On changing the plant from long to short-day conditions, there is, after 3-5 days, a decided decrease in acidity, which would indicate the transition from the vegetative to the flowering stage; acidity then increases again. In the cases of long-day plants, when exposed for short periods they assume the rosette-development type, accompanied by a low acidity. When subsequently exposed to long periods, stem-growth and flowering take place; such development is associated with a general increase in acidity.

By increasing the length of the periods of exposure, changes take place also in the form of the carbohydrates and in the degree of hydration. In the Cosmos (short-day plants) changed from long to short periods, there is, after 48 hours, an increase of the reducing sugars, which, after a further two days, assume the form of polysaccharides, while the water content of the tissues decreases. Twelve days later, after the shoots have appeared, the increase in the sugar-content is again in the form of monosaccharides,

and there is a considerable increase in water. Observations also made on other plants show the marked influence of the periods of exposure to light on the conditions mentioned. A. F.

33. **Changes in Hydrogen-ion Concentration Produced by Growing Seedlings in Acid Solutions.**

DAVIDSON, J. and WHERRY, E. T. *Journal of Agricultural Research*, Vol. XXVII, No. 4, pp. 207-218, tab. 5, bibliography. Washington, D. C., 1924.

The numerous recent investigations on soil reaction have been mostly directed towards the problem of the influence of this reaction on plant-growth, while few have studied the problem from the other side, that is the effects of plant growth on the reaction of the means which supply nourishment to the plant itself. The authors, by the water culture method, have grown plants in solutions of hydrochloric acid, nitric acid, sulphuric acid, phosphoric acid, formic acid, acetic acid, oxalic acid, succinic acid and benzoic acid.

Among the inorganic acids the greatest changes take place with nitric acid, in the first stages of growth and with phosphoric acid in the last. As phosphorus and nitrogen are the most essential elements to plant growth, it may be concluded that the changes in initial reaction caused by the plant are due to absorption rather than to neutralisation.

The culture of plants in nutritive solutions, deficient in acid-forming elements, lessens the capacity of the plant to decrease the acidity of the solution itself, probably due to functional disturbances in the plant-cells. The greatest changes took place with organic acids, which may be attributed partly or perhaps wholly to microbial activity. The fact that under certain conditions there is a greater diminution of one acid, and under other conditions, of another acid, indicates that the cause of these changes lies in preferential absorption. This term was introduced by the authors instead of elective absorption, inasmuch as with the latter it may be indicated that some substances are excluded from absorption, whereas the former indicates only the greater absorption of one substance rather than another. That it is a question of absorption and not of neutralisation is shown by the fact that the diminution of acidity is observed only in the case of certain acids and not in that of others, even at the same initial hydrogen-ion concentration and with the same constant of disassociation. It is precisely this fact that indicates preferential action. A. F.

Plant Breeding.

34. ***Nicotiana deformis*** **n. sp. and the Enzymatic Theory of Heredity.**

HONING J. A., *Nicotiana deformis* n. sp. und die Ensyntheorie der Erblichkeit *Genetica*. Vol. V, Nos. 5-6, pp. 455-476, figs. 5. S. Gravenage, 1923.

Nicotiana deformis originated in the year 1914 in Sumatra, being a bastard growth of Deli tobacco. It has never flowered in the tropics.

[33-34]

In Holland however all the specimens bear flowers when the temperature of the hot-houses is not tropical. The new species therefore is not adapted to its place of origin and has shown constancy for the first time in cold places.

Nicotiana deformis differs from the normal Deli tobacco by a slighter growth, a plentiful formation of collateral buds, and irregular long-stalked leaves through the absence of flowers, in the tropics. All these differences occur at the same time and are therefore due to a single cause.

A cross between the bastard and *deformis* gives 586 bastards and 590 *deformis* plants, and a cross between the bastard and the normal Deli, 549 Deli and 541 bastard plants in both cases; the proportion therefore is 1 : 1.

The leaf excrescences do not appear to be hereditary. The bastard is in all respects intermediary, but its characteristics are not all of the same intensity. All three types (the normal Deli, the bastard and the *deformis*) begin by forming regular leaves. This process may be explained if it is assumed that the difference between *N. deformis* and the normal Deli tobacco is quantitive and that the hereditary factors are of an enzimatic nature. *N. deformis*, with its leaf and flower anomalies reminds us not only of the Kroepoek disease, but also of the plants with the mosaic disease.

The genuine *deformis* shows somewhat slower initial growth than the Deli tobacco. G. B.

35. **Inheritance of Composition in Fruit through Vegetative Propagation.**

CHACE, E. M., CHURCH, C. G., and DENNY, F. E. (Laboratory of Fruit and Vegetable Chemistry). *United States Department of Agriculture, Bulletin* **No. 1255, p. 18. Washington, D. C., 1924.**

The object of this investigation was to ascertain whether or not there are characteristic differences of composition in lemons, which may be connected with the physical characteristics in fruits raised from different stocks. If such differences in composition really exist, the results obtained in the investigation will be useful for testing the progress of work in the improvment of lemon varieties. The data given relate to the analysis of specimens of lemons gathered from trees belonging to distinct stocks of the Eureka and Lisbon varieties.

In the latter variety, the "Dense unproductive" stock produces lemons having a greater specific weight than that of the "Bell" stock. The latter on the other hand has a larger proportion of rind than any other. The "Lisbon" stock is the most acid; the "Dense unproductive" is a little less so, and the "Open" still less. In the Eureka variety the Eureka stock is more acid than that of the "Shade Tree"; there may be other differences, but not such as to draw any conclusions from.

The results of the authors' investigations show the possibility of obtaining through graft selection (based on the choice of the best types, including therein a comparison of the fruits and examination of their physical characteristics) stocks especially adapted for the production of the

essential oil and acid, or other accessory products. In any case, a more definite standard is thus obtained than by any other method for comparing the quality of fruits. It is to be hoped that these investigations will lead to practical conclusions in the choice of varieties to be cultivated for various purposes. A. F.

36. Investigations on Sugar-Cane Cytology.

BREMER, G. (Proefstation voor de Java-suikerindustrie). De cytologie van het suikerriet. Een cytologisch onderzoek van eenige practijkssorten en hare ouders. *Archief voor de Suikerindustrie in Nederlandsch-Indië*, No. 6. Soerabaja, 1924.

The previous investigations made by the Author have shown that the primary forms of Saccharum have varying quantities of chromosomes, which fact is of considerable importance in the classification of species. They also show that the number of chromosomes in the crosses between *Saccharum officinarum* and *S. spontaneum* is nearly the same as that of the parent plants. These results open the way to the discovery, through cytological tests, of the origin of the variety.

This second series of cytological tests has been made on the varieties of *Saccharum* met with in practice. These varieties are also interesting in connection with the cross-growths problem, as showing how the number of chromosomes varies, tracing back to the parent-stock. Thus the Author has found that in the SW 3, SW III and DI 52 varieties there are 40 aploid chromosomes, whereas their diploid chromosomes number 80. The progenitors of these varieties, Zwart Cheribon and Batjan, both varieties of *Saccharum officinarum*, have invariably 40 aploid chromosomes. The 100 POJ variety possesses 89 diploid chromosomes. In the "Loethers cane", which comes from *Saccharum officinarum*, there are 98-99 diploid chromosomes. The supposition that the latter is the parent of the former seems confirmed by the number of chromosomes. The 89 (100 POJ chromosomes) is equal to the sum of the 40 aploid chromosomes of "Bandjarmasin" and $\frac{99}{2}$ ("Loethers" chromosomes).

The Author, after numerous other examples, concludes by observing that in the sugar-cane there is probably some relation between fertility and the decrease, never regular, of the reduction division. Both, in all probability, are influenced by unfavourable growth conditions. A. F.

37. Bud Selection Work in Hawaiian Sugar Plantations.

C. A. B. *International Sugar Journal*, Vol. XXVI, No. 308, pp. 412-414. London, 1924.

The article summarises the recent work on bud selection of sugar canes as carried out by SHAMEL, VERRET, and PARIS. The advantages of bud selection are stated and changes due to bud variation, such as colour variation and the breaking down of striped canes into one-coloured canes (see, The origin of new sugar canes by bud-variation. Dr. C. A. BARBER, C. I. E. *Agric. Jnl. of India*, Vol. I, October 1906).

The methods adopted are described for the choosing of the best clumps of cane in the field, the selection and planting of tops for seed, and the repetition of the process, year by year, until uniformity is obtained.

SHAMEL mentions the appearance of a number of mutations.

Plantation managers report that the improved condition of their crops is largely due to the use of better planting material.

Selections are at present based on the weight of cane per foot of row, owing to the difficulty of recognising the type wanted, but in the plantations a much more careful selection of seed is being made.

At present the work has two aims, (*a*) mass selection for plantation seed; (*b*) bud selection for obtaining new and improved types. PARIS proposes to separate the two, to keep back the present system for a time and to concentrate on the study of pure strains.

Two schemes have been drawn up and are given in detail for the methods to be adopted in mass, and in bud selection. W. S. G.

38. **Importance of Selection as Related to Grafting on Acid-Fruit Trees.**

A. D. SHAMEL, C. S. POMEROY and R. E. CARYL, Bud Selection as related to Quantity Production in the Washington Navel Orange. *Journal of Agricultural Research*, vol. XXVI, n. 7, p. 319-322, 2 tav. Washington, D. C., 1923.

The number and quality of the fruits produced by citrus trees is a character transmissible by propagation through grafting. The tests show that the presence of unproductive acid-fruit trees is due to the unintentional propagation of growth variations of this character. This fact brings to light the great importance of accurate selection when grafting onto acid-fruit trees, in order to avoid unproductive races.

A fact which should especially to borne in mind is that the leaves of sterile shoots have a different appearance from those of normal shoots.

G. B.

39. **Inheritance of Petal Spot in "Pima" Cotton.**

KEARNEY, T. H., *Journal of Agricultural Research*, Vol. XXVII, No. 7, pp. 491-512, 1 tab. Washington, D. C., 1924.

The Egyptian cotton similar to *Gossypium barbadense* is characterised by a conspicuous spot at the base of the yellow petals. The spot is completely absent in most of the varieties of mountain cotton (*Gossypium hirsutum* L.). The hybrid between the "Pima" variety of Egyptian cotton and the "Holdon" variety of mountain cotton has a unifactorial segregation. The subject is of practical importance through the possession of a quality of "Pima" cotton such as that with petals "free of spots", and this fact may also be appreciated by an agriculturist.

Cotton is subject to cross fertilisation; it is therefore a great advantage to have a character which proves race purity. The absence of spots on the petals is a recessive character which may be transmitted without difficulty to other races of the "Pima" variety. G. B.

40. **Mass Selecting in Philippine Rice Fields.**

MONTEMAYAR, Z. T. *The Philippine Agricultural*, Vol. XIII, No. 4, pp. 167-175, tables 6, plate 1. Los Baños, Laguna, 1924.

Mass selection may be defined as the process of selecting the best plants in a field, mixing the seeds and then planting *en masse*. This method has been employed on a large scale for rice in the Philippines since 1915.

The objects of the author's work were : (*a*) To determine the difference in yield between mass-selected and non-selected rice seed ; (*b*) the difference in yield between mass-selected and non-selected seed from a field planted one plant in a hill ; (*c*) to find whether or not mass-selection in a field planted singly, is better than mass-selection in fields where there is more than one seedling to a hill.

The experiments were carried out in 1922, 1923 and 1924 on both upland and lowland varieties of rice.

It was concluded from the experiments that :

(i) Seed, mass-selected from rice fields having several plants to the hill, did not always give increased yield.

(ii) Seed, mass-selected from a field with one plant to the hill, gave increased yield when this seed was planted one plant to the hill.

(iii) A hectare of one plant to the hill field would produce more mass-selected seed than the same area of the ordinary field with several plants in a hill.

W. S. G.

Seeds.

41. **Seed Maize Improvement.**

McKEON, C. (Maize Specialist, Department of Agriculture), *Queensland Agricultural Journal*, Vol. XXII, Part 4, pp. 282-286, Plates 3. Brisbane, 1924

A scheme of seed maize improvement has been carried on for a number of years by the Department of Agriculture, involving highly technical work, and cooperation has taken place with growers in various districts. The average yield of the whole State for the 10 year period ending 1922 was only 21 bushels per acre.

The following yields from improved varieties have been obtained by individual farmers :

Improved Yellow Dent.	117	bushels	per acre
Reid's Yellow Dent	116	»	»
Golden Beauty, a five-months maize . . .	93	»	»
Star Leaming, a four-months variety . . .	80	»	»
Funk's 90-day variety	69	»	»

To maintain this improvement, sufficient pure seed will be grown each year to sow several thousand acres of maize.

W. S. G.

a manure lorry with a balance basket worked by the backward motion if the lorry which allows of the reverse action being regulated with the necessary precision.

II. This new balance arrangement for baskets, boxes and platforms has been devised for a new type of rural motor tractor, a " manure lorry " or " manure tractor " especially intended for the transport of manure, soil, and crops, and for general transport on cultivated land and country roads. It is characterised by its platform, or box, mounted on a pivot upon the chassis of the tractor, or vehicle in tow. It can be attached at the moment required to the wheels carrying it, so as to move backwards simultaneously with the backward motion of the lorry. Figure IV shows the box of the vehicles on the chassis ; it is balanced between the two wheels and its centre of gravity passes as near as possible to their axes. Figure V, shows the operation of attaching the box to the wheels which by their rotation as they move back cause the balance motion. In the figures : *a*) is the axis of the pivots which are attacked to the chassis (not represented), on these pivots are mounted the supports of the box ; *b*) is the axis of the wheels which are the driving-wheels of motor vehicles and of the fore-carriages of tractors, and may also be the wheels of a vehicle that is been towed and is rigidly coupled to its tractor. This brake is provided with a patten, and runs in a slide carried by the box and worked from the forepart of the lorry, by means of a hand-lever, *d*, for instance.

The apparatus works as follows : while on the road, the box is kept in the position shown in figure IV. When the vehicle has reached the place for unloading, it is stopped, the pattens are tightened and the vehicle is made to move back and the pattens are fixed on the wheels which carry them down with the box to which they remain solidly attached.

The return action of the vehicle is stopped (this is done by the band-brake already described), as soon as the inclination of the basket is sufficient to allow it to discharge its load, either wholly, or partially. In order for the return movement of the vehicle and the inversion of the box (which needs an additional, but proportionally slight amount of force), to be carried out simultaneously, it is necessary for the motor-wheels to be able to grip properly if they are working on damp, or loose, land such as cultivated fields, roads with many ruts, in forests, or quarries. For this reason, these vehicles were always provided with wheels of large diameter, fitted with permanent land-grips able to work equally well in both directions. (American, English, German patents).

160. Hand-Worked Garden Tractor.

DESSAISAIX, R. Tracteur horticole à bras. *Revue Horticole*, Year 95, No. 24, pp. 542-543, figs. 2. Paris, 1923.

M. CH. PUTOIS (Condray-Montceaux, France), has invented a small hand-worked tractor. It has two wooden wheels 0.95 m. in diameter which are affixed to an axle and are 0.50 m. apart. The wheel-rims are bound with T-shaped irons 0.045 m. in height ; these form the gripping-irons of the machine which weighs 150 kg. The naves of both wheels carry

rachet-wheels that can be turned in one direction by pawls articulated with a frame turning in the vertical plane round the axis. To this frame is attached a lever of which the length can be regulated and which can be worked by a man and turns the wheels. When the lever is drawn back, the pawls become disengaged from the cogs of the rachet-wheels and the tractor remains stationary.

With a lever 12 m. long, the traction force at disposal is twice as great as the force exerted by the man for an average advance of 0.55 m. per stroke of the lever. When the lever is 1.50 m., 1.80 m. and 2.10 m. long, these figures are respectively: 2 ½ and 0.47 m., 3.29 and 0.33 m., 4.90 and 0.29 m.

R. D.

161. **The Burmester Plough.**

BURMESTER, H. Der Garepflug. *Die Landmaschine*, Year 3, No. 83, pp. 415. Berlin, 1923.

The author describes a plough that he has invented and the manner in which it works. The object in devising the implement was to turn the slice not all at once, but in such a manner that the lower, and much the larger portion should be turned over on the furrow, while the upper part, which is composed of the dung spread on the field and of the superficial stratum that must be broken up to form the seed-bed, is turned over upon the deeper-lying slice. This insures the seed-bed being in the best chemical, physical and biological condition; further, it allows the microflora of the soil to develop rigorously, while the manure finds its way to the layer where it can become completely incorporated in the soil and be assimilated by the plants.

The BURMESTER plough is fitted with two shares, the front and upper share lifts the superficial layer of the soil on which rests the manure and carries it to one side, while the lower share cuts and turns the deeper-lying slice; then the upper layer is inverted so that the manure lies between the upper and the lower slice. The back and lower share is inserted as vertically as possible in order to turn over and break up the bottom part of the slice properly. The depth of the ploughing is regulated by the same method as that adopted in the case of deep-working SACK, or ECKERT, ploughs.

F. D.

162. **Sub-Soil Ploughs.**

RINGELMANN, M. Charrues sous-soleuses. *Journal d'Agriculture Pratique*, Year 87, No. 49, pp. 454 458, figs. 5. Paris, 1923.

On any given farm, ploughing is always carried out to an almost constant maximum depth with the result that the repeated passage of tht share compresses the soil just below the layer ordinarily worked by the plough and a pan is formed that retains the rain-water. Fortunately this hard crust is not entirely continuous, but contains crevices through which the roots are able to make their way although with some difficulty.

The experiments made by the authors have proved several facts as regards this hardpan.

ter yields may be obtained, viz., by better cultivation, manuring and better seed.

The crop is considered under the following heads: - cultivation, manures, sowing, harvesting, storage, seed selection, transplanting.

W. S. G.

46. **Fertilising Rice.**

JASEHKE, O. (Agric. Chemist, Crowley Experiment Station, La.). *The Rice Journal*, Year 27, No. 7, pp. 14-15. New Orleans, La., 1924.

In Louisiana, in former times, rice was broadcasted without any fertiliser and yields were obtained of from 67 to 90 bushels (42 lb.) per acre, whereas now the yield in many of the older sections of the State has fallen to about 25 bushels per acre. This is largely due to the fact that for 20 or 30 years these soils have grown crop after crop of rice, without rotation of other crops and only occasionally was the land pastured for a year or two.

To remedy this, acid phosphate was applied, but the improvement at first caused, soon ceased. Then phosphate-potash mixtures were tried, but with no better results. Finally, nitrogen was added, but this aided weed growth and choked out the rice.

A careful study revealed the causes of the failure; the formula was unbalanced, more potash was necessary; the soil was almost depleted of humus, and the one-crop system caused the increase of diseases and weeds.

The experiments had shown that fertiliser alone will not maintain a profitable yield, but that the remedy lay in the inclusion of a leguminous crop. The Biloxi soy bean was found to be the most suitable, and its inclusion, together with suitable fertilisers transformed the soil, upon which new varieties of rice have since been developed. Farmers now harvest as much as 2000 lb. of paddy per acre; the plant nutrients removed by this crop are replaced by the soy bean crop and the balance is maintained.

W. S. G.

47. **Rice in Malaya.**

JACK, H. W. (Economic Botanist, F. M. S. and SS.). *Bulletin* No. 35, pp. 96, Map I, plates 20. Kuala Lumpur, Federated Malay States, 1924.

The author has a thorough grasp of his subject and in this monograph treats very fully the many aspects of rice growing; the comparative values of different varieties are discussed and the necessity for the selection of strains with a high tillering power in order to obtain increased yield, also, the superiority of heavy over light grain for seed purposes.

Attention is drawn to the great importance of this cereal, which has been cultivated for more than 4000 years, and is now the staple food of over 60 % of the population of the world.

The author records the results of experimental work carried out

during the past six years in the Malay States by the Botanical Division of the Department of Agriculture.

The subject is treated under the following heads: Distribution, irrigation, soils, cultivation, harvesting, yields, native methods of milling, pests and diseases, economics, varieties, manures, catch crops, improvement of the rice crops. W. S. G.

48. **Potato Trials in Scotland.**

Board of Agriculture for Scotland. Report of the Plant Registration and Testing Station, pp. 96, tables. Edinburgh, 1924.

Report of experiments made with numerous varieties of potatoes in Scotland during the past year, with a view to testing the yield capacity before placing on the market. Each new variety is compared with a control variety in the same class. The simple average yield of a number of plots is not considered as a sufficiently accurate indication of the yielding value of the variety under the given conditions. Consequently, a new scheme of calculation has been devised which facilitated the estimation of the real value, taking into account the probable experimental error of the plots and making adjustements and comparisons accordingly.

M. L. Y.

49. **Size of Potato Sets: Comparisons of Whole and Cut Seed** (1).

STUART, W., LOMBARD, P. M., VOSBURY, M. C., CORDER, G., EDMUNDSON, W. C., CLARK, C. F., and DEWEY, G. W. (Office of Horticultural Investigations, Bureau of Plant Industry). *United States Department of Agriculture, Bulletin* No. 1248, pp. 1-43, figs. 12, tables 15. bibliography. Washington, D. C., 1924.

Although reports from various quarters are somewhat conflicting as regards the yield of potatoes from whole and cut tubers the data obtained as a result of experimentation in the States permit certain practical conclusions. Where there is a deficiency of moisture and plant food, medium sized cut sets are advised, as the relative number of tubers produced will have a chance to reach a marketable size. A study of stem frequency correlation shows that, as the weight of the whole seed increases from 2-6 ounces the stem frequency varies from 3 to 7 stems respectively. Halved sets show a variation from 2 to 4 stems, and quartered sets from 3 to 6 ounce tubers average 2 stems.

The authors review the causes for disagreement as to the practicability of planting whole or cut sets and draws attention to the varying climatic and soil conditions, and more especially to the spacing of the sets to allow the maximum development. A comparison is made of the experiments carried out by numerous investigators and a detailed description is given of the tests made in recent years in the States.

M. L. Y.

(1) See *R.* 1920, No. 1096 and *R.* 1921, No. 492. (*Ed.*)

50. Potato Production under Irrigation.

RAMSAY, J. T. *The Journal of the Department of Agriculture, Victoria, Australia*, Vol. XXII, Part 7, pp. 355-360, Fig. 4. Melbourne, 1924.

The peculiarities of soil environment and climatic conditions demand variation in methods of irrigation and cultivation. The author bases his statements on normal conditions and prevention of excessive moisture. In this case, irrigation one month from the date of planting has been found effective.

Instructions are given as to the advisable methods to follow prior to irrigation:— date of planting; preparation of land for planting; manuring; cultivation. The weight of seed per acre recommended is from 12-16 cwt. preferably sprouted, and early varieties.

In practice, from 5-8 chains has been found the most satisfactory length for water to run, and on clay loams irrigation should be at a slower rate than on light soils.

The importance of cultivation after each irrigation is accentuated. The danger of excessive application of water is shown by the liability of low quality tubers to rot.

M. L. Y.

51. The Modern Trend of Forage Crop Improvement.

MCROSTIE, C. P. (Dominion Agrostologist, Central Experiment Farm, Ottawa). *Scientific Agriculture*, Vol. V, No. 1, pp. 13-17. Ottawa, 1924.

The author treats his subject from three standpoints: crop distribution and classification; experimental methods; crop improvement.

The definition of agricultural zones would be a distinct advantage, but to make use of such it is necessary to have a crop classification that will give information of the varieties and strains of forage crops, and at present a satisfactory classification is lacking. To supply this want in the case of mangels, about 10 000 measurements were made of the best varieties. Four measurements were taken of each root: length, width at widest part, depth in the ground, and distance from tip of root to widest part. The following table gives the averages for varieties listed by seedsmen:

Variety	Length width ratio	Length depth ratio	Length distance to widest point ratio
Long	3.310	1.981	1.299
Half Long	2.915	2.044	1.329
Intermediate	2.065	2.261	1.511
Tankard	1.594	2.088	—
Globe	1.074	2.405	1.597

The table shows that there is a well defined difference between the length-width and length-depth ratios of the types. These differences are definitely co-related with adaptations to particular soil types and conditions, and are therefore of economic significance.

The seedsman's descriptions are not sufficiently accurate, and a better classification is essential if growers are to receive full protection under the new Seed Control Act.

As regards experimental methods: In comparative tests for yields of varieties, reports were almost always given in terms of the harvested, or green weights. The dry matter contained in the crops is the important factor, hence such green-weight reports may be very misleading, and the relative positions of varieties will be radically changed, as shown by the author, if the report is given in terms of dry material rather than as green weight.

The improvement of forage plants has been less rapid than that of cereals, owing to the former being generally open-fertilised.

The purification of a plant as regards its character can be done most quickly by self-fertilisation, as by that means, in four or five generations the true breeding strains may be separated. Inbreeding may result in decreased yield, in which case recombination of desirable strains may be necessary to restore vigour. However, many of the best timothy strains, inbred for 5 generations at the Central Experiment Farm gave higher yields than the best commercial mixtures.

Another feature of modern work is the utilization of hybrid vigour shown by many first generation plants resulting from crosses of dissimilar types; maize hybrids promise to be of economic value.

Finally, there is a trend among plant breeders of all kinds to co-operate in experimental work, which will bring about better and more uniform results. W. S. G.

52. The Agricultural Value of Trefoil.

BRESAOLA, M. *Le Stazioni sperimentali agrarie italiane*, Vol. LVI, parts 7-8-9, pp. 313-325, bibliography. Rome, 1923.

In the tests made by the author on plots of 100 m², under as far as possible the same conditions, a comparison was made of 8 different kinds of trefoil and 10 of clover, including some foreign varieties. It was proved that the influence of origin on the crop value of the seed necessitates still more restricted regional classifications than have hitherto been made. With regard to Italy, the utilisation of Italian seed is not sufficient, attention must be paid to the place of origin. If the tests had been carried out contemporaneously in all the districts from which the seeds came the results would, in all probability, have been different, and favourable to the respective home variety.

Low temperatures cause clover to thin out, tests made in this connection showed the great resistence of the home variety. In mixed varieties there are sometimes small species having a varying degree of resistence to cold. Selection after repeated sowings, while it leads to the thinning out

of the meadows, eliminating the less resistent plants, will soon give a variety particularly well adapted to local conditions and therefore more productive. Seed production is scarce in Italy and should therefore be encouraged. In view of the great increase in fodder production every initiative in this direction would be valuable. A. C. M.

53. **Fodder Value of *Melinis minutiflora*.**

WHITTET, J. N. *Agricultural Gazette of New South Wales*, Vol. XXXV, Pt. 6, pp. 431-432, figs. 3. Sydney, 1924.

Reference has recently been made to the value of "efwatakala" grass (*Melinis minutiflora*) in Africa, in connection with the tse-tse fly problem (1). The author draws attention to the tests made in New South Wales since the introduction of this plant some years ago. The matter of planting this grass (here known as "molasses" grass) in tick-infested areas has received consideration, but the fact that stock are not partial to this plant presents a certain drawback.

As regards cultivation, as a tropical grass, it requires a long summer season with heavy rainfall and good soil conditions if introduced into non-tropical climates. The main methods of propagation are by rooted cuttings, runners or divisions of the main root system.

M. L. Y.

54. **Tropical Gramineae Harmful to Pastures and Stock and Fodder Value of other Plants in the Belgian Congo.**

VANDERYST, H. I. Graminées Tropicales reputées nuisibles. — II. Appetibilité pour le bétail de quelques graminées cultivées au jardin agrostolograque de Leverville. *Bulletin agricole du Congo Belge*. Vol. XIV No. 4. pp. 545-568. Brussels, 1923.

I. — A list and description of the various species of Gramineae deleterious (1) to arable land; (2) to pastures; (3) to live stock, based on observations made in the Belgian Congo.

II. — A classification of forage plants of superior, medium and inferior value for sheep, and others entirely avoided by stock.

M. L. Y.

55. **Improvement of Grassland.**

HANLEY, Dr. J. A. (University of Bristol). *Journal of Ministry of Agriculture*, Vol. XXXI, No. 3, pp. 251-260, tables 3. London, 1924.

There are large areas of poor grassland in Yorkshire which can be very much improved by the application of suitable phosphatic fertilisers. Some of the commonest indications of land requiring phosphates are

(1) See *R.* 1923, No. 187. (*Ed.*)

growths of hawthorn, wild rose and sedges; fescues are often the chief grasses.

On heavy soils, or on light soils with a good supply of moisture, either high, or low-grade basic slags, or finely-ground mineral phosphate usually gave satisfactory results on grassland requiring phosphate, but the lighter and drier the soil the more soluble should be the phosphate employed. Steamed bone flour alone, or mixed with superphosphate, gave good results on light, dry grassland, whereas superphosphate alone answered well on limestone land.

Disappointment is often caused through the use of inadequate applications; the initial application should not be less than the equivalent of 10 cwt. per acre of phosphatic manure containing 30 per cent. total phosphate of lime.

In some instances where lime or phosphatic fertiliser made a marked improvement in poor grazing land, the addition of potash produced a further improvement, but this was always small in comparison with that due to lime or phosphate alone.

The experiments indicate that it is better to make the application of phosphates (and lime if necessary) the first step in the improvement of poor grazing land, and to give adequate dressings to the whole area to be improved before supplementing such treatment by the addition of potash. The evidence is more definitely in favour of the use of potash for hay crops from temporary leys or permanent meadows, especially if no farmyard manure is used. W. S. G.

Industrial Crops.

56. Cotton in Peru.

The information on which these notes have been based has been derived from the following sources:

(1) Communication from Señor Oscar Victor SALOMÓN, Peruvian Consul General in London, dated 16 September, 1924.

(2) *Commerce Report, Supplement* No. 43 (Washington); also, particulars from the *Trade and Economic Review*. Data relative to trade and production have been communicated by the Peruvian Government.

(3) *Estadística de Comercio Especial del Peru*. Superintendencia General de Aduana, for the years 1910 to 1924; Extracto estadístico correspondiente del año 1918, preparado por la Dirección de Estadística del Ministerio de Fomento, 1915 to 1918.

(4) Consular Reports to the British Foreign Office on the finance, industry and trade of Peru, 1921 to 1924.

(5) "*Peru, the Cradle of South America*", July, 1924, No. 1, p. 18. London, Peruvian Consulate General.

(6) F. B. Peel, a Director of the Liverpool Cotton Association has also supplied information.

(7) *The Cotton Growing Countries.*

The coast of Peru consists chiefly of a line of arid sand dunes, intersected by numerous river valleys. These rivers have only short cours-

es, nowhere exceeding a length of 100 miles, and many of them descend in less than fifty miles from their sources in the Western Cordillera of the Andes to their discharge into the Pacific Ocean. The steep water gradients thus formed have been favourable to irrigation in the valleys, and the channels required for this purpose had been extensively provided in the era of the Incas, if not earlier. Cultivation in those days appears to have been chiefly concerned with the supply of food for the considerable population then found in Peru. As this coast-region is almost entirely rainless, water for agriculture of any description is, as a rule, only obtainable by means of irrigation.

Cotton growing and manufacture were undoubtedly Peruvian industries during early times; this fact is attested by the numerous exquisitely coloured cloth fabrics recovered from the cemeteries of the Inca Empire. The Inca dynasty appears to have included keen agriculturists and great industrialists among its members; there is evidence to show that the manufacture of cotton textiles was more than enough for Peruvian requirements, and allowed supplies to be sent to the territories now known as Chile and Ecuador, and indeed to more remote parts of the Peruvian Empire. Under Inca rule strenuous work was imposed upon the whole population, with excellent results, both agricultural and industrial.

During their three centuries of dominion, the Spanish Government had established factories, and granted permission to the natives to continue their cotton weaving. The irrigation channels, however, fell into decay during this period, and by degrees cotton growing was practically abandoned. Even after Peruvian independence was achieved in 1821, the output continued to be on a comparatively insignificant scale, until the American Civil War, when the great rise in the price of cotton encouraged the planting of varieties hitherto unknown in Peru. But there was no instruction available as to methods of growing the crop, nor any knowledge of scientific developments; this sudden prosperity was only temporary, and the industry soon relapsed into its previous stagnation.

It was not until 1899 that any real progress in cotton growing was apparent in Peru, but after that date a remarkable and rapid increase in production was to be observed.

There are at least 35 valleys in which cotton is grown, and twenty ports from which it can be exported. The areas are relatively small and isolated from each other by the recurrent line of sand dunes, which detracts so much from the interest of a voyage along the west coast of South America. Many of the snow-fed streams from the Andes run dry during the autumn months, and planting is therefore only practicable during the flood season or when irrigation remains possible.

The wonderful climate of these valleys and their suitability for cotton growing may be attributed to the evenness of the temperature; the difference between the day and night readings of the thermometer, being almost regular, provides the most favourable conditions for the growing plant. The salt spray from the ocean breezes deposited upon leaf and stalk provides a layer of sodium chloride, and the prized "Full Rough"

Peruvian cotton is the result. This roughness becomes more pronounced with the degree of proximity to the sea, while on the other hand, attempts to grow a similar grade at a distance from the shore have usually failed. In fact, as the intervening mileage increases, the cotton grown from "Full Rough" seed becomes less rough, and the equally famous "Moderate Rough" is obtained in the upper portions of several of the valleys, in this way.

For a few years after 1899, the increase in production was rapid, the average export reaching 17,000,000 pounds, by 1907, and 35,000,000 in 1908. Disaster, however, followed, for the cotton plant is nowhere immune from disease. The fungoid growth at the ground level, which produces wilt, had gradually sapped the strength of the plant, during its life period of five or six seasons.

After 1908 the yield everywhere diminished rapidly, and it was feared that the whole of the cotton crop might disappear. Plant after plant became infected, there was a cessation of any appreciable yield. Whole fields were destroyed and there was very little expectation of finding any satisfactory remedy. But the occasion produced an investigator equal to dealing with the situation.

Señor Fermin Tanguis came to Peru from the West Indies, early in life and after some twenty years of varying experiences, in 1893 he began cotton growing on his own estate, Hacienda Urruita, with the knowledge gained from practice, and with some printed descriptions of the methods of selecting perfect cottonseed and healthy plants, as adopted in other countries; he devoted his entire attention to a scheme for combatting the attacks of wilt which had resulted in such wide spread destruction.

The principle upon which he worked was the simple one of evolving, by a process of elimination of the unfit, the perfect mother-plant from selected seed of *suave*, or smooth, upland cotton. During three successive seasons he made careful sowings of selected seed on an infected area. In the first, and again in the second season conditions remained unchanged, the wilt still prevailed and destroyed all the crops. But in the third season a single plant stood erect, and was quite free from infection. In the fourth season the seed collected from this mother plant produced others, true to type. In the fifth season Señor Tanguis was in a position to sow seven acres with the new type of cotton, which has since borne his name. Nearly forty acres were sown in the sixth season, and in the seventh Señor Tanguis began to supply seed to cotton planters in the Department of Ica. Occasionally plants do not remain immune, but these cases are so rare that they do not vitiate the possibility of plentiful crops.

In some valleys, such as that of Cañete, Tanguis cotton is grown on the largest scale and yields sometimes reach 800 pounds of lint per acre. The same plant may remain in being for five seasons; the staple attains a length of 1 $^3/_4$ inches, with a very strong resistance; it is classed as half (or moderate) rough. Of all the cotton now growing in Peru, 60 % has in fact been derived from the single mother-plant reared by Señor Tanguis.

In the Government statistics of exports so lately as 1918, Tanguis Cotton is not separately mentioned, but in the data for 1922 this variety easily heads the list, with an export figure of 32,212,000 pounds. It forms part of the cotton shipments from fourteen out of the twenty ports tabulated in the Government returns in which the aggregate exports of cotton from Peru in 1922 are given as about 88,000,000 pounds. Sixteen years ago, previously to the wilt attack, the whole Peruvian cotton shipments of 35,000,000 pounds only slightly exceeded the figure of Tanguis cotton exported in 1922.

The system of selection adopted by Señor Tanguis is not now confined to the variety which bears his name. As and when required, Full Rough plantations have been subjected to the same methods of careful selection. This Full Rough cotton is not only indigenous in Peru, but is unique, not being found in any other country; the essential conditions of favourable climate and soil made fertile by irrigation are nowhere else combined with that propinquity to the sea which is required for its production of the rough texture. Full Rough cotton bears twice in the year, and is good for five or six crops without replanting. It is so woolly in texture that scientific analysis may sometimes be necessary to differentiate it from real wool, and the Yorkshire manufacturers value its properties.

It is only from the parts of Callao and Payta, in Northern Peru, that Full Rough Cotton has been exported and to the extent of about 6,800,000 pounds in 1922. About 800,000 pounds of this cotton was yellow stained from weather effects, and presumably most of it went, as usual, to United States' buyers.

The cotton known as Moderate Rough or Half Rough (semiaspero) is usually available for export in smaller quantities than Full Rough, and is shipped from the same northern ports of Peru; as already mentioned, this grade of cotton may be considered to be the result of planting Rough seed at a distance from the sea coast; the quotation in Liverpool is usually about 10 per cent lower for Moderate Rough than for Rough Peruvian Cotton.

The original and indigenous unimproved *Gossypium Peruvianum* is still grown in such valleys as Catacaus, Sechura, and the ancient forest area in La Chira, which is so much enriched from the point of view of present agricultural conditions by deposits of river alluvium. Here in La Chira and elsewhere the method of planting usually adopted is to sow in small holes, 15 or 20 feet apart, in unploughed land and to irrigate by means of channels from the river. In the spaces between the cotton plants melons, pumpkins or beans are sown. The first crop of cotton matures in about eighteen months but does not give a full yield. In the following seasons however, production continues to increase until the sixth crop, then the plant dies off. Of all Peruvian growths this unimproved *Gossypium Peruvianum* gives the lowest average yield of 215 pounds per acre; yet this is a higher output than that obtained of late years in the United States.

Gossypium Barbadense (Suave or Smooth Peruvian) derived from Am-

rican Upland cotton, forms its best plantations at Lambayecque in the Rimac (Lima) valley, in Chancay, Lurin, Cañete, Chincha and the Ica region. It thus extends along most of the sea front of Peru, and contributes to the export figures of nearly twenty ports with an aggregate of about 20,000,000 pounds (1922 figures). The Upland Cotton requires more water than the indigenous varieties, previously mentioned, and generally compensates for the extra care, by producing better results. In Lambayecque the average has been fully 500 pounds of lint to the acre, and in the Ica valley 562 pounds have been registered, while in Chancay, Chillon and Rimac, variations in yield from 360 pounds up to 830 pounds are recorded.

The Upland Cotton plant has become perfectly acclimatized and grows in the form of a shrub from 3 to 4 ½ feet in height. Its period of bearing is about two years, the output declining sharply both in quantity and quality in the third year.

Of the *Gossypium Barbadense*, the production of actual Sea Island Cotton is trifling, but the derivation from the same original stock is said to be maintained in Mitafifi Cotton, received in Peru from Egypt, and also figuring at the present day in the Peruvian exports to an extent of about 20,000,000 pounds.

This cotton is grown in the valleys of Pativilca, La Chira, Supe, Huacho, etc. and, finds its outlet at most of the twenty Peruvian ports of shipment. The yield averages about 500 pounds of lint per acre.

There is yet another region where indigenous cotton has given good results, though, so far, on a somewhat limited scale. The Montana, or Peru Oriental territory is one of vast possibilities, with great areas of fertile soil. It is situated to the east of the great range of the Cordillera, and is watered by the upper courses of rivers tributary to the Amazon.

The variety of cotton produced in this Peruvian Orient is known as Chanchamayo, and about 2,200,000 pounds were exported from the river port of Iquitos, down the Amazon, in 1922. Most of the cotton shipped from Iquitos is classed as Moderate Rough, and has a staple of 1 $^1/_8$ to 1 $^3/_{16}$ inches.

Throughout the country, the cotton plantations are mainly in the hands of well-to-do Peruvians, who employ the labour of the Indian natives. A large proportion of the dwellers in Peru are almost entirely self-supporting, or rather self-providing, as communities, in respect of food and clothing, so that much of the cotton grown is devoted to domestic requirements of all sorts.

In the Apurimac valley, new spinning mills have been established, and the demand for the raw material has led to a considerable extension of the cotton area.

The ginning is in many cases carried out locally, on the estates themselves, and the cottonseed is very extensively utilized in crushing mills, with a resulting trade in cotton cake and oil.

In Peru the list of cotton plant pests and diseases is not a long one So far, there is no trace of boll weevil or of pink bollworm (*lagarta rosada*). The *arrebatada* does some damage nearly every season, but the extent of

injury is not large. The fungoid attacks resulting in wilt have already been mentioned, and have caused by far the most serious losses to Peruvian cotton-growing, though, in recent years, careful seed selection and cultivation, on the Tanguis plan have rendered the risk of wilt less formidable than it was fifteen or twenty yearsago.

According to the expert opinion of Señor Oscar Victor Salomón, Peruvian Consul General in London, who is the chief authority quoted on cotton-growing in Peru, there are three miillion acres of land in that country which are suitable for cotton. Undoubtedly this opinion is contingent on the provision o f efficient means of irrigating the whole of the territory indicated.

In the 35 valleys scheduled as cotton growers in the Peruvian Government's Statistics the present area under this crop does not greatly exceed 200,000 acres; there is, evidently plenty of room for extension, conditional always on the provision of irrigation facilities. At the beginning of these notes reference was made to the ancient water channels as forming an indispensable foundation for cotton growing. Some notice of the new efforts for increasing the water facilities may properly conclude the present statement.

The Pampas Imperial Scheme has already provided for 20,000 acres and the Carhuaqueros Dam, fifty miles inland from the port of Pimentel will, when complete, furnish water for another 125,000 acres in the neighbourhood of Lambayeque. As food and other crops will share in the benefits of these new ventures, the additions to cotton production cannot be very rapid, though perhaps fairly continuous, as suggested by recent Government figures of exportation, given in the following table:

Exports of Cotton (lint) from Peru.

Calendar Years	thousand pounds
1910	31,099
1911	35,026
1912	42,396
1913	52,731
1914	50,486
6915	46,573
1916	53,408
1917	38,306
1918	47,449
1919	87,551
1920	75,341
1921	30,306
1922	83,083
1923	93,470

The war years, and recurrent low prices, may account for adverse fluctuations in export trade.

J. H. H.

[56]

57. ***Musanga Smithii* and its Value in Paper Manufacture.**

THIRIET, A. Parasolier et papier de parasolier. *L'Agronomie Coloniale*, Year 10, No. 77, pp. 145-152, plates 7. Paris, 1924.

The author reviews the various reports from different countries relative to the fibre value of *Musanga Smithii*, and describes in detail the characteristics of the wood obtained in the Cameroons, and the subsequent treatment and quality of the paper obtained. The reports are favourable and the quality of the cellulose is considered equal to that of straw; a yield of 35-40 % is estimated. Treatment with bisulphite has produced a durable cellulose of good colour, with a yield of 50 %. It is estimated to obtain 25-30 % of superior fibre from the bark, and provided the economic conditions improve it is considered that *Musanga Smithii* should serve as a valuable source of raw material for the paper industry on the West Coast of Africa.

The plates illustrate clearly transverse sections of the wood.

M. L. Y.

58. **Factors affecting the Protein and Oil Content of Soy beans.**

STARK, R. W. *Journal of the American Society of Agronomy*, Vol. XVI, No. 10, pp. 636-645, tables 6, bibliography. Geneva, N. Y., 1924.

The increasing use of soybeans, both as a feed for livestock and as a source of oil, led the author to make further investigations into the composition of the bean, as it had been observed that the composition varied when the plant was grown under different environmental conditions.

The following conclusions were arrived at as a result of the experiments:

An increase in yield of beans is frequently associated with an increase in protein content and a decrease in oil.

Applications of limestone and organic matter caused a marked increase in protein and the effect was further increased by the addition of rock phosphate. The addition of potash resulted in a decrease in the percentage of protein and an increase of oil.

The yield of oil in pounds per acre was increased by applications of organic matter. The addition of limestone caused a large increase in oil, but phosphorus and potash had little effect on the yield of oil per acre.

Wide variations may exist in the composition of the same variety of soybeans when grown in different localities.

Conditions which produce an increase in the percentage of protein result in a decrease in the oil content and *vice versa*.

Soybean oil may be used as a substitute for linseed oil in the manufacture of paint and varnish. The iodine number was found to differ according to the variety (121 to 130), but no consistent relation was found to exist between the iodine number and location or soil treatment.

W. S. G.

[57 58]

59. Varieties of Coconuts in Ceylon.

STOCKDALE, F. A. (Director of Agriculture, Ceylon). *Tropical Agriculturist* Vol. LXII, No. 4, pp. 204-209, 19 plates. Peradeniya, Ceylon, 1924.

The article gives a detailed description of nineteen types of coconuts, with external and internal dimensions, also the weights of the whole nut, husk, shell and meat. Photographic reproductions are given of each of the nineteen types, and particulars as to colour, size, shape of nut, relative amounts of kernel, shell and husk

The best types of nuts were brownish in colour, whereas green nuts were inferior.

Plants from each of the selected types have been put down on the estate of Mudaliyar A. E. RAJAPAKSE at Jaela, and at the Experimental Station, Peradeniya, for future investigations. W. S. G.

60. The Production of Vegetable Oils in Chile.

La producción de aceite vegetale en el país. *Boletín de la Sociedad Nacional de Agricultura*, Vol. LV, No. 5, pp. 352-357. Santiago, 1924.

According to the official reports for 1922, the importation of oils into Chile has been very extensive in recent years. Consequently steps have been taken to exploit the native resources and improve existing methods of oil extraction, and in general, to cope with the increasing demand.

A survey is made of the principal oleaginous crops and the average yield of oil: — olives, grape pips, linseed, soya, peanut, castor oil, rape, radish.

A description is given of the cleaning, decortisation and methods of extraction varied to a certain extent according to type of seed. A special apparatus for hot pressure is employed, which proves very effective; full details of the process are given, with the subsequent treatment.

M. L. Y.

61. The Cultivation of Sumac (*Rhus coriaria*) in Spain.

JANINI JANINI, R. (Jefe de la Región Agronómica de Valencia). *Revista del Instituto Agrícola Catalán de San Isidro*, Year LXXIII, No. 3, pp. 45-46. Barcelona, 1924.

The author points out the advantage which would ensue from cultivating this plant in the soils in which the reestablishment of vineyards presents difficulties and in which other crops are not possible owing to excessive heat, lack of moisture, etc. The plant is used in tanning and dyeing and is extensively cultivated in La Roda (Province of Albacete, the Mancha), which has poor soils and extremes of climate, and where there is a Society with an excellent installation, which has obtained yields 2 % higher than the largest establishments in Sicily, which have a good reputation. The inhabitants of the Mancha cultivate the male sumac in clayey soils and the female in lime soils, the leaves of the first giving 28 % of tannin and those of the second 22 %.

The Sicilian sumac yields more than that of the United States of North America, giving sometimes as much as 35 %.

The author describes the methods of cultivation and gives details of planting, labour, harvesting, transport and production. E. M. F.

62. **Rubber Planting Questions.**

DARBY, H. D. E. *India Rubber Journal*, Vol. LXVIII, No. 11, pp. 18-19. London, 1924.

In the article, the author, who has been rubber-planting since 1889, answers various questions on the growing of rubber.

The probable life for tapping purposes of *Hevea brasiliensis* when grown in the East, is probably not less than 50 years; there are thousands of acres in the Malay States from 20-25 years old which are still yielding. The life can be prolonged if the following precautions are taken: the planting area should be cleared of all jungle roots to a depth of 30 inches, below which fungoid root disease probably cannot exist. Only selected seed from healthy parents should be used. All precautions should be taken to retain the surface soil, by growing cover crops, or by other means. On flat land the soil should be aerated by digging.

The most satisfactory planting distance for trees is 25 × 25 ft., or 70 trees to the acre.

As regards tapping-systems: it is recommended that half the circumference of the tree be tapped daily at six-weekly or two-monthly alternations, and then resting for a similar period.

On young estates, where the land is flat, clean weeding is a good practice, but on slopes a cover-crop is advised.

With reference to disease: If the estate is cleared of all subterranean roots and timber there should be little fear of white ants or root disease. Disease of the trees above ground is largely a matter of supervision, and with competent mycologists at hand should not be dangerous. The most serious disease at present is "mouldy rot".

For all-round estate work the Tamil is the best type of labour.

The majority of good properties in the East have up-to-date machinery, but large factory installations are costly in up-keep, and it is improbable that in future, new estates will erect such large installations.

W. S. G.

63. **Cover Plants for Rubber.**

The Tropical Agriculturist, Vol. LXIII, No. 2, pp. 76-77, Plates 3. Peradeniya Ceylon, 1924.

The realisation of the serious effects caused by soil erosion has awakened interest in cover plants, indigenous specimens of which have been submitted to the Department of Agriculture for examination.

In the case of rubber there is need of some protection of the soil in the early stages, and green manure plants have been employed, such as

Crotalaria striata, and other small, shrubby plants; these protect the soil from the sun, but are not satisfactory in preventing soil erosion. To prevent soil erosion small creeping or prostrate plants are to be preferred, as erect-stemmed plants allow the surface water to cut channels between their stems. In the selection of plants, otherwise suitable, those should not be introduced which are difficult to eradicate.

Several species of *Phaseolus* appear to meet requirements; *Desmodium* sp. are being tried in the low country, and *Cassia mimosoides* in the highlands.

To facilitate identification of the indigenous plants, illustrations and full descriptions are given in the article of *Desmodium triflorum*, *D. heterophyllum* and *D. heterocarpum*.

W. S. G.

64. The Present Status of Hevea Bud-Grafting.

The India Rubber World, Vol. XXX, No. 6, pp. 793-794. New York, 1924.

The article is a summary of the report of H. C. PINCHING, senior scientific officer of the Malaya Rubber Growers' Association, on his visit to Java and Sumatra, where he made a thorough investigation of the extent, results and possibilities of bud-grafting

In Java, bud-grafting has not been employed to any great extent, but in Sumatra 20 000 acres have been planted with vegetatively raised plants. On Malayan estates bud-grafting has not, as a rule, been taken up, except in the Kajang district where one estate has planted more than 1000 acres

Allusion is made to the work of Dr. CRAMER, of Buitenzorg, who is not yet prepared to advise bud-grafting on a large scale.

Results show that as a means of raising new plants the method is satisfactory, and that the extra cost should not exceed $15 per acre. A marked feature of bud-grafted trees is the cylindrical shape of their trunks, also, the similarity of trees raised from buds obtained from the same tree. Generally, the bark of such trees is thinner than that of seed-grown trees and the renewal of tapped bark is slower and poorer. Buds taken from high-yielding trees do not invariably give rise to high-yielding offspring, but sufficient data on yields have not yet been published to support or disprove the success of bud-grafting as a means of raising areas of high-yielding trees.

It is extremely difficult yet to estimate to what extent the high-yielding characteristic of a tree is due to the constitution factor, or the "environment" factor.

The author considers, that, for the present, it seems advisable to plant mixed bud-grafted and seed-selected plants, about 200 per acre and then to remove the low yielders.

There is great similarity, as stated above, between trees belonging to the same clone, that is, raised from buds cut from the same tree, and some scientists regard bud grafting as a suitable means of isolating high-

yielding clones, rather than as a direct means of obtaining material for planting estates.
W. S. G.

65. Yield and Growth in *Hevea Brasiliensis*.

BRYCE, Dr. G. and GADD, C. H., *Department of Agriculture*, *Bulletin* No. 68, pp. 74, tables 50, bibliography. Peradeniya, Ceylon, 1924.

In a previous publication by the above authors data are recorded relative to 161 trees, raised from seed at Peradeniya. Certain relationships were found between yield and girth, cortex thickness, and number of of rows of latex vessels. It was considered desirable to repeat the investigations and to extend the scope of the work.

Considerable variation was found to exist in the yielding capacity of the trees, but those which gave the highest yields during the first year of tapping gave the highest yields in the second year, and similarly with girth, cortex thickness, and number of latex vessel rows in the cortex at 2 feet above ground level. It was also found that for the first year of tapping, trees giving the highest yields are also those with the greatest girth, most numerous latex rows, and thickest cortex. In other words, the character " yield " is interrelated with the characters girth, number of latex rows and cortex thickness.

The coefficient of correlation between yield for 1921-1922 and 1922-1923, indicates that generally the high yielding trees for the first year are also the high-yielders in the second year, and the low-yielding trees continue to give low yields.

It has been advocated that the best yielding trees are those with the highest number of latex rows. The authors' work showed that closer relationship exists between the yield of one year and that of the next, than between yield and any other character; hence, the selection of high yielders should be based on yield records. The operation of measuring girth is much simpler, speedier and less expensive than the determination of the number of rows of latex vessels of the cortex. As the correlation for characters girth and yield is higher than that for number of latex rows and yield, girth as an indirect measure of yield is to be preferred to characters of the cortex.

The application of the statistical method to agricultural experiments enables the worker to extract from the masses of figures their exact significance, together with the degree of reliability of the result.

As regards manures, the authors know of no experiment which has proved that their application directly increases the yield of rubber, although manures increase the growth and general vigour of the trees. It is concluded that yield is independent of vegetative growth.

Yield is an inherent character ; a tree is, in general, a good or a bad yielder and no special cultivation will change a poor into a good yielder. Cultivation in estate practice should therefore be directed towards the maintenance of trees in normal health and growth, to enable them to give the greatest yields that their inherent character renders possible.
W. S. G.

[65]

66. Rubber Tapping Experiments.

HOLLAND T. H. (Manager, Experiment Station, Peradeniya). *Tropical Agriculturist*, Vol. LXII, No. 4, pp. 195-198. Peradeniya, Ceylon, 1924.

An account is given of experiments carried out from 1919 to 1923.

Two-day tapping yields versus three day tapping yields. Three series of trees for each method were studied for 5 years and gave the following yields of rubber: alternate day tapping averaged 19.9 lb. for the 5 years (3.98 lb. per annum), whereas those tapped every third day yielded only 13.15 lb. Of trees tapped every two days, 5.8 % showed signs of brown bast disease, as compared with 1.1 % of the trees tapped every third day. No difference could be noted in the rate of bark renewal.

Comparison of V cut and single cut. Half the trees in this experiment were tapped with a single cut at 16° and half with a V cut, both on half the circumference, and tapped on alternate days throughout the year; 152 trees were tapped on each system. The results did not indicate any advantage in the V cut, as regards yield, which confirms experiments made in 1914.

W. S. G.

67. The Influence of progressive Applications of Nitrate of Soda on the Quality of Sugar Beets.

URBAN J. and SOUCEK (Institut der Csl. Zuckerindustrie). Ueber die Wirkung gesteigerter Chilisalpetergaben auf die Qualitat der Rube. *Zeitschrift für die Zuckerindustrie der Cecoslovakischen Republik*, Vol. XLVIII, No. 48, pp. 449-456. Prague, 1924.

The trials were carried out on experimental plots, treated with top dressings of nitrate of soda in amounts equivalent to 100, 200, 300, 450 kg. per hectare. It was ascertained that the first 100 kg. increased the yield per hectare by 1800 kg.; with the second 100 kg. of nitrate an increased yield of 1600 kg. was obtained; with the third an increase of 1500 kg; and with the last 150 kg. of nitrate an increase of 500 kg. The sugar value of the beets treated with 100 and 200 kg. of nitrate was the same as that of untreated plants; the stronger doses of 300 and 400 kg. reduced the sugar content by 0.1 to 0.2 % while the purity of the juice was diminished by 0.3 %. The sugar yield per hectare was increased by 320, 320, 250, 80 kg. respectively, according to the amount of the dressings. The total nitrogen content increased by 2, 4, 8 and 10 % respectively.

These results are not of general application to all types of soils. In certain cases the effect of the treatment was most unfavourable, the sugar value being reduced by 0.75 %; elsewhere the quality of the beets treated with nitrate was the same as that of untreated plants. Where the yield on untreated plots was already abundant, the addition of nitrate reduced the sugar content and the purity of the juice while the amount of nitrogen was increased. On the poorer soils, however, the nitrate exercises a beneficial influence not only upon quantity but also upon quality.

A. F.

68. **The Yield from Sugar Beet in Colorado.**

JARREL, J. F. The Beet Stand, and Losses in Yield. *Louisiana Planter and Sugar Manufacturer*, Vol. LXXII, No. 25, p. 493, New Orleans, 1924.

Experiments carried out at Longmont Experiment Station College show that the best spacing for the development of a sugar beet is about 240 sq. inches or 26 133 plants per acre. In practice this stand is equivalent to 100 beets in 100 feet of row, if the rows are 20 inches apart.

The Longmont Station, since 1914, has weighed about 500,000 beets, the average weight per beet being 1.27 lb., which with the above spacing would give a theoretical yield of 16.596 tons per acre. In 1923, in Colorado, the actual yield obtained from over 90 000 acres was 16.914 tons per acre, which is very near to the Longmont figure. However, the average for Colorado during the past 8 years is only 11.33 tons per acre, or less than 70 % of the yield assumed to be possible by the Longmont investigations.

There is no doubt that spacing materially affects the yield and that close supervision at thinning time will repay the farmer. W. S. G.

69. **Selected Coimbatore Canes in Growers' Fields in North Bihar.**

SAYER, W. *Agricultural Journal of India*, Vol. XIX, No. 5, pp. 493-499. London, 1924.

As a result of through testing at Pusa the seedlings Co 210, Co 213, and Co 214, were found to be superior to the canes grown in North Bihar in tonnage, sucrose content and freedom from disease. Seed-cane from these varieties was distributed in 1923 to growers who were asked to report their experience with these canes.

From the reports received it is seen that the Coimbatore seedlings have shown their superiority, under similar conditions, over the local cane in the growers' own fields. Co 213 is preferred both by growers and sugar factories. It is easily first in tonnage, second in sugar and lowest in fibre. The three canes are now well established in North Bihar, and at Pusa investigations are being carried out as to their ratooning qualities.

Since the above was written, further reports have been received from the growers, who state that the Coimbatore seedlings, although planted on soil deficient in moisture, have successfully withstood the exceptionally hot weather and are now far ahead of the local canes.

W. S. G.

70. **Summary of Experiments on Sugar Cane, Soils, etc.**

EASTERBY H. T. and PATTEN G. R., *Bulletin No.* 4, *Bureau of Sugar Experiment Stations*, pp. 94. Brisbane, Queensland, 1924.

The *Bulletin* contains an account by the Director and Analyst of the Department of Agriculture, on experiments with sugar cane and on soil treatment, and soil and other analyses, carried out from 1902 to 1923. The value of deep subsoil-ploughing was shown, the increase of cane per acre being 19.8 tons, and of sugar per acre 2.8 tons ; a similar increase was shown by the ratoon crops. Mixed manure (nitrogen, potash and phosphoric acid),

6 cwt per acre, gave increases in yield of both cane and sugar. The addition of lime, up to 6 tons per acre, to red soils did not produce a satisfactory increase.

Cane planted in rows 4 feet apart gave 20 tons per acre more cane than when the rows were 7 feet apart, and the yield of sugar was also greater with the closer planting. W. S. G.

71. Cultivation of Sugar Cane in Queensland.

EASTERBY, H. T. (Director, Bureau of Sugar Experiment Stations). *Bulletin* No. 3 (Revised Edition). *Queensland Bureau of Sugar Experiment Stations*, pp. 48, plates 13. Brisbane, 1924.

The Bulletin treats the subject under the following main heads: Taking up virgin scrub lands, forest lands, clearing and planting, cane cultivation on old lands, irrigation and manures, varieties, analytical data, weather conditions, pests and diseases. The Bulletin concludes with brief descriptions of the sugar districts of Queensland, for the assistance of prospective growers. W. S. G.

72. Nipah Palm and Sugar Content of Juice in connection with Alcohol Manufacture (1).

EATON, B. J. and DENNET, J. H. Further Reports on the Nipah Palm. *The Malayan Agricultural Journal*, Vol. XII, No. 6-7, pp. 154-162, tables 5. Kuala Lumpur, 1924.

Report of the tapping experiments made in Malaya with estimates of the sugar con tent of the juice of the Nipah palm, and an investigation made in connection with the disappearance of alcohol from the juice after standing for some days.

A catch drain was made round a group of palms to ascertain whether any changes in yield were forthcoming. Results indicated that the yield is greatly increased by keeping a permanent supply of water round the roots of the palms. It was observed that juice is obtainable for the whole twelve months of tapping, at an average rate of 1 quart per palm per day. It has still to be determined if these yields can be maintained in consecutive years.

The analyses demonstrated the variability of the sugar content of the juice. For palms giving normal yields, the calculations indicate an average of 5-6 ounces per day, with the exception of the commencement and end of tapping. As regards the keeping properties of the preserved juice, the results show the value of sulphuric acid to prevent premature fermentation if the alcohol is to be used for specific yeasts, although in the manufacture of sugar, the acid is not advisable owing to the production of invertose. Further investigations are in progress. M. L. Y.

73. The Yield of Budded Cacao.

HARLAND, S. C. *Tropical Agriculture*, Vol. 1, No. 5, pp. 66-69. Trinidad, 1924.

Report of a series of experiments with budded and grafted cacao made by the Trinidad Department of Agriculture at River Estate.

(1) See *R.* 1923, Nos. 112, and 492. (*Ed.*)

The results indicate that there is no correlation between the yield of the parent and the mean yield of its budded offspring. Consequently the value of a tree for budding purposes can only be estimated from the mean yield of its budded offspring. Taking into account the variability of soil and growth conditions it has, however, been noted that the low yield is not due to environment, but is inherent. The analysis made of a block of trees demonstrates this clearly. Certain trees although high bearing individually, may produce budded offspring of low yielding capacity, entirely of an inherent nature.

The author discusses the yield of cacao relative to the development of the tree and the physiological causes of high and low yield and subsequently, the possible effect of vegetative reproduction on each of the main stages of productivity. Reference is made to the effect of budding on the shedding of young fruits of cotton, and on the yield of rubber, and it is suggested that the physiological condition of the stock and type of root system is the predominating factor in the setting of fruit and that due consideration should be given to this fact in vegetative propagation. The bud grafting rubber tests made in the Dutch East Indies and elsewhere confirm the foregoing conclusions, and observations on grafted apple trees have given similar evidence. M. L. Y.

74. ***Salvia Spinosa*, a Useful Aromatic Plant in Cyrenaica.**

CAVARA, F. Una salvia da essenza della Cirenaica. *Profumi italiani*, Year II, No. 2, pp. 29-31, figs. 3. San Remo, 1924.

In ancient records frequent references have been made to *Salvia Sclarea* and other *Salvia* species, and according to observations made at the Botanic Gardens, Naples and elsewhere, the so-called *Salvia spinosa*, common in Cyrenaica, corresponds very closely with certain of these species. Until now the plant has only been considered of interest from the botanical standpoint, quite apart from any possible commercial value.

A distinct similarity exists between this species and *S. Sclarea*, a plant well known for its perfume. This, fact, combined with facility of cultivation and adaptability to dry climates, should encourage the cultivation of *S. Spinosa* in the future. M. L. Y.

Horticulture and Arboriculture.

75. **Relation between the Composition of Californian Cantaloupes and their Commercial Maturity.**

CHACE, E. M., CHURCH, O. G., and DENNY, F. E. (Laboratory of Fruit and Vegetable Chemistry). *United States Department of Agriculture. Department Bulletin* No. 1250, p. 27, fig. 2. Washington, D. C., 1924.

The aim of this study is to establish certain facts that would assist agriculturists and exporters in judging of the ripeness of cantaloupes, so that the ripe fruit only should be picked first. Results obtained show that

as cantaloupes ripen, they contain a larger quantity of solid substances and of saccharose, and that the refractive index of the juice increases, while the percentage of starchy matter in the seeds is lessened.

The sap of cantaloupes gathered when ripe, has a specific gravity of at least 1.040 (equal to 10 % of solid matter) and a refractive index of at least 55 and contains at least 4.5 % of saccharose. The seeds of the ripe fruit contain less than 5 % of starch.

When gathered, cantaloupes gain in perfume but not in sweetness. If preserved at low temperatures, as in refrigerators, the fruit undergoes little alteration, so that the composition after storage appears to be the same as at the time of gathering. When softened at ordinary temperatures, only a small quantity of saccharose is lost. After gathering however, the loss of starchy matter in the seeds is maintained. A. F.

76. **The Propagation and Cultivation of Citrus Trees in Egypt.**

BROWN, T. W. *Ministry of Agriculture, Egypt, Technical and Scientific Science Bulletin*, No. 44, pp. 1-88, plates 33. Cairo, 1924.

This book gives a comprehensive account of citrus growing in Egypt. The work includes details of propagation, care of seedlings, care of young plants in the grafting, budding, choice of stocks, planting, planning the orchard, cultivation, diseases and pests, description of varieties. Reference is made to the importance of windbreaks which consist of evergreen trees such as *Casuarina*, *Eucalyptus*, Cypress and Sycamore. On no condition should trees such as *Eugenia Jambolana* and *Ficus retusa* var. *nitida* be used, as these are usually infested with scale insects. This applies also to mango trees which are infested with orange scale. To protect from the sun's rays, it has been recommended to plant *Poinciana* at intervals of 28 metres.

As an effective hedge, *Caesalpinia sepiaria* and *Aberia Caffra* are mentioned. M. L. Y.

77. **The Pollination of Cherries applied to Commercial Cherry Growing.**

HOOPER, C. H. *The Journal of Pomology and Horticultural Science*, Vol. III, No. 4, pp. 185-190. London, 1924.

Observations based on pollination trials with early, mid-season, and late flowering varieties of cherry, 1912-1923. Attention is drawn to the importance of noting the average length of time in full flower, in conjunction with the relative order of flowering, when grouping trees in the orchard. M. L. Y.

78. **The Seedless Breadfruits of the Pacific Archipelagoes.**

WESTER, P. J. *The Philippine Agricultural Review*, Vol. XVII, No. 1, pp. 24-39. Manila, 1924.

This list of breadfruits grown in the Pacific Archipelagoes has been compiled to make available the scattered information on this subject.

and to show the remarkable number of forms that have been envolved. All the varieties are seedless unless otherwise indicated. M. L. Y.

Forestry.

79. **Pencil Cedar from East Africa.**

Journal of the Royal Society of Arts, Vol. LXXII, No. 3751, p. 818. London, 1924.

The timber resources of Kenya Colony have recently been surveyed by the Government, and it is considered that at present it would not be profitable to export either hewn or sawn timber of ordinary kinds, as the areas of supply are hundreds of miles inland. However, a wood known locally as "mutarawka" (*Juniperus procera*) is thought to be suitable for pencil cedar, of which the usual type is said to be fast disappearing. The wood is a handsome reddish brown, soft wood, with fine even grain, rather brittle, aromatic, and cuts easily with a knife. It is estimated that sufficient supplies are available to keep up a sustained export in pencil slats until such time as reafforestation timber will be ready for exploitation. Mutarawka is found in the highlands and is shipped from Mombasa. W. S. G.

80. **The Blue Gum (*Eucalyptus globulus*). Notes on its Physical Qualities, Conversion and Uses.**

SCOTT, M. H. *The South African Journal of Industries*, Vol. VII, No. 9, pp. 576-578, figs. 3. Pretoria, 1924.

Reports of the experiments made at the Pretoria Seasoning Kilns on locally grown blue gums (*Eucalyptus globulus*). The author discusses the physical properties and draws attention to the variation in weight; the average was found to be 48 lbs. per cub. ft., oven dry, but as much as 35.5 lbs. difference was noted between the maximum and minimum weight. This variation occurred in the same tree. The specific gravities vary from 1.10 to 0.52 (=68.0 and 32.5 lbs. per cub. ft. respectively).

Recommendations are made with reference to sawing and prevention of splitting and casting, or sideways warp. It is preferable to saw down the centre first and then to cut at right angles to the original cut.

As regards loss in conversion, i. e. cutting boards to size from the log in the round, taking the total shipment as 100 cub. ft., 38 % was accounted for by slabbing and 12 % by saw-dust, allowing 7.5 % for defects and 4.7 % for shrinkage.

Hitherto this wood has been considered to be almost impossible to season and, consequently, suitable only for rough work. The seasoning kiln tests have, however, demonstrated the practicability of stack drying and air drying, in winter or late autumn, but more especially by artificial seasoning. A detailed description is given of this last method. The cut boards were placed part in a water spray kiln and part in a fan kiln. The time taken to season was 52 and 31 days respectively. No further split-

ting took place in either kiln during the drying process, and defects were negligible.

Examples of flooring with wood thus seasoned show the value of the process and the time saved. M. L. Y.

81. **The Saligna Gum (*Eucalyptus saligna*). Its qualities and Uses.**

SCOTT, M. H. (Forest Department, Pretoria). *The South African Journal of Industries*, Vol. VII, No. 8, pp. 504-506. Pretoria, 1924.

Nearly all the indigenous forests of South Africa produce hard woods, not easily worked, or suitable for use in general construction work. *Eucalyptus saligna* has been introduced and will in time supply a part of the country's soft wood requirements.

When first cut the wood is pinkish-white and the heart not easily distinguished from the sap; afterwards the heart darkens and the sap turns a greyish-white.

The wood is softer and less dense than most gums; it nails and glues well and polishes easily. The weight when dried averages 36 lb. per cubic foot, but when freshly cut may reach 70 lb.

As with all other varieties of *Eucalyptus*, there are in the living tree strong internal stresses, which when the tree is cut are freed to a certain extent and cause splitting. The waste from this cause is from 10 to 20 %. *Eucalyptus saligna* has been successfully seasoned artificially.

W. S. G.

LIVE STOCK AND STOCK BREEDING.

General.

82. **The Eggs of Tuberculous Fowls as a means of Transmitting Avian Tuberculosis.**

FITCH, C. P., LUBBEHUSEN, R. E., DIKMANS, R. N. Report of experiment work to determine whether avian tuberculosis is transmitted by the eggs of tuberculous fowls. *Journal of the American Veterinary Medical Association*, Vol. XVI, New Series, Vol. 19, No. 1, pp. 43-53, bibliography. Detroit, 1924.

Avian tuberculosis has become very important, not only on account of the development of aviculture but because of its connection with the tuberculosis of other domestic animals. It is generally admitted that avian tuberculosis is transmitted by the excrement of infected fowls; it has also recently been asserted that the eggs of those affected with tuberculosis constitute a means of dissemination.

After having referred to the investigations and results arrived at up

to the present day, the authors give the results of their own investigations.

They utilised 62 fowls, of which only 43 laid, which implies that about 30 % of tuberculous fowls, in all stages of the disease, produce no eggs. 876 eggs were examined ; 367 by the Erlenmeyer method of flask culture and 509 by inoculations in guinea pigs. The tuberculosis germ was found in a group of 9 eggs coming from 2 different fowls.

It may therefore be safely concluded that less than 1 % of the eggs laid by tuberculous fowls contain live tuberculous bacteria. The authors have shown that chicks may be hatched by incubating infected eggs and that it is possible for an egg naturally infected, to give birth to a tuberculous chick. It is however absolutely denied that this can take place in practice and be of a nature to cause an active dissemination of the disease.

The authors have also examined the shells of 209 eggs laid by fowls recognised as tuberculous and sullied by excrement. The shells were carefully washed in a sterile saline solution which was afterwards centrifuged : the sediment was injected in fowls intraperitoneally : in no case did the injection cause tuberculosis.

The general conclusion may be drawn that the egg plays no important part in the transmission of avian tuberculosis. P. D.

83. The Effects of Adding Vitamine-Rich Substances to Normal Rations for Poultry.

ORR. J. B., CRICHTON, A. and NORTH, B. M. (Rowett Institute) ; KINROSS, A. (West of Scotland College of Agriculture) ; MOIR, M. (North of Scotland College of Agriculture) ; NEWBIGGIN, H. (East of Scotland. College of Agriculture). *The Scottish Journal of Agriculture*, Vol. VII, No. 3, pp. 266-277, tables 12. Edinburgh, 1924.

I. Results of various tests made at the aviculture sections of the "Rowett Institute" and the 3 "Scottish Colleges of Agriculture", to determine whether the use of vitamine-rich substances give results of any economic value when added to the normal ration of fowls bred for profit under ordinary practical conditions. The authors first mention the results obtained in previous investigations and then give in detail the tests carried out simultaneously in 4 centres, to determine the effect of adding cod-liver oil to the normal, rations on (1) growth, (2) laying, (3) hatchability. In the various cases in question care was taken to have the members of each lot comparable in point of breed and age ; in addition they were all closely related.

(4) Growth tests.

Test I (Rowett Institute) : 2 lots of 6 Leghorn chicks ; each lot had a cage (1.8 × 1.2 m.) with wooden floor and sawdust litter. The cages are kept in a well-lighted room but the birds are not exposed to the direct action of the sun's rays.

Ration : Wheat and oat meal, paste composed of maize + bran + oat flour + fish meal + bone meal (4 : 4 : 4 : 2 : 1), gravel and water, always within reach of the birds, which also receive 5 cc. of mangel juice per head per day.

Lot I : 5 cc. of cod-liver oil per head per day mixed with the paste.

Test II (East of Scotland College of Agriculture) : 2 lots of 10 Anconas, in fowl-houses with open-air run on bare earth of 184 m².

Ration : Wheat and maize meal : paste composed of bran, crushed oats, middlings, fish meal, dried yeast, maize flour (12 : 12 : 12 : 2 : 1 : 1). Grit and water.

Lot I : 1 cc. of cod-liver oil per head per day.

Lot II : 1 cc. of linseed oil per head per day.

Test III (West of Scotland College of Agriculture) : 3 lots of 70 White Leghorns aged 7 days at the beginning of the test. Ration composed of grain and grain by-products, plus milk for 14 days, afterwards replaced by fish meal. Lot I received at first $^1/_5$ cc. of cod-liver oil per head per day ; at the end of 6 weeks this was increased to ½ cc.

Lot II an equal quantity of linseed oil.

Lot III, no oil.

Table showing results of growth test.

	Average weight at beginning of test	Average weight at end of test	Daily average gain per head 90 days	Daily average gain per head 230 days
	grams	grams	grams	grams
Rowett Institute.				
Cod-liver oil Lot	411	1183	8.6	—
Linseed oil Lot	521	1489	10.7	—
Edinburgh.				
Cod-liver oil Lot	615.7	1475.8	9.6	5.00
Linseed oil Lot	613.8	1438.6	9.2	5.04
Kilmarnock.			48 days	
Cod-liver oil Lot	31.1	342.4	6.5	—
Linseed oil Lot	34.0	365.1	6.9	—
No oil.	34.0	367.9	7.0	—

In every case the birds were in excellent condition at the end of the test period. The above results afford no proof that the addition of cod-liver oil to the normal ration is attended with favourable results on the growth of chicks. This coincides with the results obtained by KNOX and LAMB at the " Iowa State College " (1924). These Authors utilised cod-liver oil and butter as soluble vitamine sources. They obtained the following results (see page 187).

The addition of vitamine-rich substances to a normal ration does not increase growth. On the contrary, chicks receiving fats seem ailing and their records are below those of the checks.

B) Laying tests.

Test. IV. 4 lots : 2 of 12 fowls and 2 of 9, the Leghorns having a grass plot.

	Initial weight	Weight after 8 weeks	Grams of food per gram of gain in weight
	gms.	gms.	gms.
Test I.			
Check lot, no oil	42.5	103.8	5.38
2 % of cod-liver oil	40.5	169.0	5.55
Test II.			
Check, no oil	35	189	4.25
2 % of cod-liver oil	35	178	4.46
Butter (2 % of the ration)	34	142	5.02

Ration : equal parts of wheat, oats and maize siftings ; paste ; bran, middlings, crushed oats, pounded maize, fish meal (4 : 4 : 3 : 3 : 2). Lot A 5 cc. of cod-liver oil per head per day. Lot C 5 cc. of linseed oil per head per day. Lots B and D no oil.

Test. V. 4 lots : 2 of 5 Leghorn pullets and 2 of 5 Leghorns aged 2 years.

Ration : Paste : bran, middlings, maize, fish meal (2 : 2 : 1 : 1), 42.5 gm. of grain and 2 cc. of mangel juice per head per day. Water and gravel *ad lib.*

Lots A and C 5 cc. of cod-liver oil per head per day.

Test. VI. 2 lots of 10 Anconas, same ration as in V.

Lot A 1 cc. of cod-liver oil per head per day.

Lot B 1 cc. of linseed oil per head per day.

The test covered the period from September to June.

Test. VII. 3 lots of 12 Leghorn pullets having a grass run. Test lasted from October 1922 till May 1923.

Ration : Meal, maize, wheat, oats, paste : bran + fish meal + middlings, + maize flour, + crushed oats (3 : 2 : 3 : 3 : 3).

Lot B received 5 cc. of cod-liver oil per head per day, lot C. 5 cc. of linseed oil per head per day.

Test. VIII. Made in the winter of 1923-4 with 2 lots of 20 Leghorn pullets.

Ration : Maize + wheat + oats ; paste : bran, flour, crushed oats, maize flour, fish meal (1 : 1 : 1 : 2 : 2). Grit and water *ad lib.*

Lot II received 2 cc. of cod-liver oil per head per day.

Lot III 2 cc. of linseed oil per head per day.

In column A the effects of adding cod-liver oil and linseed oil are compared and it seems to follow from the results obtained that the vitamine-rich cod-liver oil has no higher stimulating effect on laying than the vitamine-poor linseed oil.

In columns B and C the effects of adding cod-liver oil and linseed oil to a normal ration are given ; results show that with the dose used these two oils have a tendency to diminish egg production.

In conclusion it may be said that if vitamine A is necessary for laying, the ordinary rations normally contain a sufficient quantity and the addi-

[83]

Average number of eggs per fowl in the laying tests.

A			B			C		
Test	Cod-liver oil	Linseed oil	Test	Cod-liver oil	No oil	Test	Linseed oil	No oil
V . . .	20.6	21.6	IV . .	47.6	53.2	IV . .	53.0	52.1
VI . . .	86.0	85.6	VII . .	123.5	143.6	VII . .	121.8	143.6
VII . . .	123.5	121.8	VIII . .	93.4	97.5	VIII . .	95.2	97.5
VIII . . .	93.4	95.2						
	323.5	324.2		264.5	294.3		270.0	293.2

tion of cod-liver oil to a normal ration seems rather to diminish than to increase egg production.

(C) Incubation tests.

Made in order to determine whether cod-liver oil influences hatchability. Eggs from the laying tests were used. The results given below show great variations in the percentage of eggs hatched but this is due to incubation factors. Though the results are not uniform, nor in accord with those of the laying tests, they nevertheless lead to the conclusion that hatching vigour is not increased by the addition of vitamine-rich cod-liver oil to an ordinary normal ration.

Incubation tests.

	No. of eggs placed in incubator	No. of eggs fertilised	Percentage of eggs fertilised	
			Hatched	Died in shell or addled
Test VI (eggs).				
Lot A (cod-liver oil)	49	36	34.3	65.7
Lot B (linseed oil)	25	18	33.3	66.7
Test VIII (eggs from)				
Lot A (no oil)	50	28	92.9	7.1
Lot B (cod-liver oil)	50	37	75.7	24.3
Lot C (linseed oil)	50	37	86.5	13.5
Test V (eggs from).				
Lot A (cod-liver oil)	26	—	57.7	42.3
Lot B (cod-liver oil)	26	—	84.6	15.3
Lot C (linseed oil)	26	—	57.7	42.3
Lot D (linseed oil)	26	—	69.2	30.8

It may be concluded in general from the various tests that the addition to an ordinary ration of vitamine-rich cod-liver oil has not proved economically profitable, which shows that the ordinary ration contains a sufficient quantity of the necessary vitamines. P. D.

[83]

84. Silage Feeding Investigations.

McCampbell, C. W., and Horlacher, W. R., *Agr. Exper. Stat., Kansas State Agricultural College, Department of Animal Husbandry, Circular* 105, pp. 10, fig. 1. Manhattan, Kansas, 1924.

A first experiment was carried out to decide the quantity of cotton oil-cake that might economically be added to a ration of shelled maize, of sugar cane ensilage fit for fodder, and of lucerne hay, for the fattening of young bullocks. Fifty Hereford cattle of the first generation were divided into 5 lots as similar as possible with regard to size, type and quality. In a 6th lot were placed 10 heifers of the same breed. Before the experiment the animals received sugar-cane ensilage and lucerne hay. In the course of the trial the animals had salt and water continually at their disposal and received a basal ration composed of shelled maize and sugar-cane ensilage at their free disposal, besides 200 gms. of lucerne hay per head per day. In addition they were given the following quantities of cotton cake per head per day: Lot I, nothing; Lot II, 225 gms.; Lot III, 453 gms.; Lot IV, 675 gms.; Lot V and VI, 905 gms.

In a table, details are given of the results of the experiment, which are shown graphically and from which the following conclusions may be drawn: —

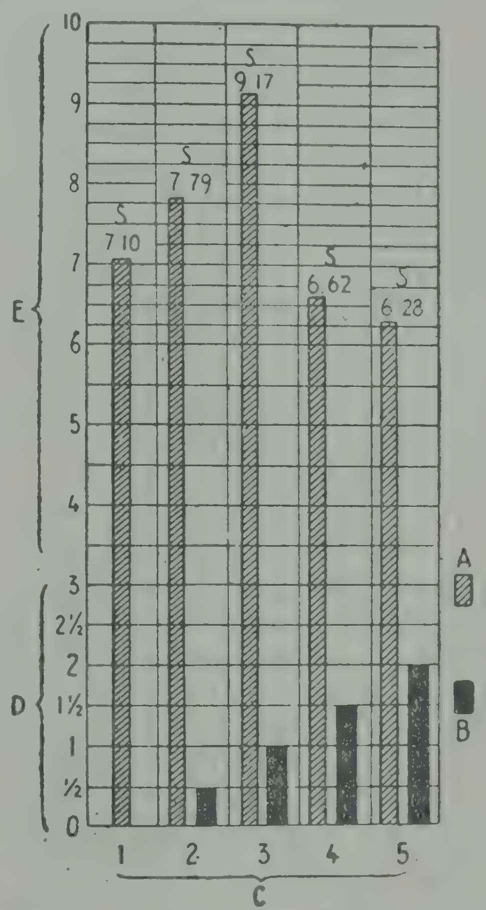

Fig. 62. — Average Medium gain per head for steers each group (in dollars) and quantity of cottonseed cake (in lbs.) fed per head daily.

A (crosslines) = gain
B (black) = quantity of cake
C = number of groups.

(1) A fattening ration for young beasts composed of maize, ensilage and lucerne hay is economically completed by the addition of 450 gms. of oil-cake per head and per day. A greater quantity is not more profitable, under present market conditions of food stuffs and cattle.

(2) Cotton cake stimulates the appetite.

(3) It is not always the animals that gain most rapidly, nor those whose ration costs most, that obtain the most benefit. It is important to combine the foods in such a manner as to obtain the most rapid gain in weight and the highest degree of fattening, with the minimum of expense.

(4) Heifers put on weight as rapidly as young bullocks and

are generally in better condition at the end of a given fattening period.

A second experiment was made to verify the often expressed opinion that cattle fed during the winter with ensilage do not thrive as well at pasture the following season.

For this purpose two lots of young bullocks were set apart, which received in the course of the winter, the one lucerne hay, and the other ensiled fodder and 450 gms. of cotton cake per head per day. During the summer all the animals were put out to pasture. The trial was continued during 3 winters and 3 summers.

The following conclusions were drawn:

(1) Ensiled fodder completed by 450 gms. of cotton cake per head per day, and lucerne hay, constitute two suitable winter rations. The choice depends entirely on which is available and on the price.

(2) The gain in weight realized by the young bullocks at pasture depends more on their condition at the time of putting out to pasture, than on the kind of food consumed during the period of the previous winter season.

(3) Lean young bullocks at pasture gain as much weight during the months of May and June as during all the rest of the period of pasturage.

A 3rd experiment was made to judge of the effect produced by finishing fattening with concentrated foods, after a period of pasturage. The conditions of feeding were identical with those of experiment No. II, but after 60 days of pasturage the animals were brought in and fed during 83 days with ensiled fodder, lucerne hay, and ground maize. Notwithstanding the defective conditions of transport to market, and in spite of the high price of concentrated food stuffs, the result of fattening with these food stuffs enabled us to gain a higher profit of 14-16 dollars per head than that obtained from bullocks sold directly after pasturage, without finishing fattening with concentrated food stuffs. P. D.

85. Olive Residues in Sheep and Pig Feeding.

GOUIN. Les grignons d'olives dans l'alimentation des moutons et des porcs — *La Vie agricole et rurale*. Year 13, Vol. XXV, No. 39, p. 218. Paris, 1924.

When the oil is extracted from pressed olives, there remains a pulp residue known as 'olive feed' which possesses rich nutritive qualities owing to its high content in oil. In this condition, it can only be given to cattle in very small quantities so as to avoid an overloading with fatty proteins which might cause intestinal and digestive troubles. Moreover this fat, oily substance, being liquid acts on and softens the fatty tissues, thus depreciating the quality of the lard in the case of pigs. The cellulose of the hard gritty fragments of the olive-stones makes digestion difficult and may, in the long run, cause irritation of the intestines.

Often, the residue from the first pressing of olives is again crushed and kneaded in water: the pulp, and fatty matter, which rises to the

surface is boiled and pressed and thus a kind of cake is produced much appreciated by sheep but which quickly turns sour and should be fed in combination with bran or coarse meal. This cake treated with carbon di-sulphide gives a cake which can be fed in small quantities to ruminants and pigs but is not easily assimilated.

In short, these by-products of olive pressing supply a poor quality of food which can be given to sheep in small quantities, provided their ordinary ration is well supplied with proteins.

Components of olive residues after extraction of oil.

	Olive residues	Olive cake	Extracted olive cake
	%	%	%
Water	27–30	14	8
Nitrogen	3–4	6	10
Fat	14–15	29	11
Nitrogen Free Extracts	29–32	42	57
Cellulose	16–23	6	8
Mineral substances	2-3.5	2.5	5

P. D.

86. **The Use of Locusts in the Feeding of Animals.**

I. THERON, J. J. and HALL, T. D. (Potchefstroom School of Agriculture) The toxicity of locusts poisoned with arsenical baits. *Journal of Department of Agriculture, Union of South Africa*, Vol. VIII, No. 6, p. 626-7. Pretoria, 1924.

II. LITTLE, A. Locusts and locust meal as poultry food. *The Rhodesia Agricultural Journal*, Vol. XXI, No. 3, p. 334. Salisbury, 1924.

I. Experiments carried out in order to determine the toxicity of locusts poisoned with arsenical baits and liable to be eaten by animals, or distributed to them in food. The bait was made up of 2 oz. of soda arsenite containing 80 % of white arsenic, 2 lb. of sugar, 2 gallons of water and $^1/_2$ sack of barley or bran.

Tests were carried out on lots of 50 locusts and in eight of such determinations only 0.1 to 1 mgm. of arsenious oxide was found in a batch; 750 of the air-dried locusts weighed approximately one pound and would therefore contain a maximum of 15 mgm. of white arsenic.

In practice, except in cases of animals possessed of extreme susceptibility to arsenic, locusts poisoned by means of bait made according to the given directions may be used safely as a feed for cattle, horses and even sheep. Pigs being more sensitive to poisons, should not be fed in this manner. As regards poultry, they would hardly be able to eat a sufficient quantity of locusts to feel any of the poisoning effects.

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Doses of arsenic fatal to full-grown animals.

	Weight of arsenic having fatal toxicity	Weight of air dried locusts containing a toxic dose
	gm.	lb.
Cattle	3 – 10	200 – 700
Oxen	1 – 3	67 – 230
Horses	0.5	30

On the other hand, should the bait used contain a higher percentage of arsenic than that prescribed, the poisoned locusts would constitute a danger.

The authors cannot recall any cases of poisoning when baits were prepared according to the prescribed directions and in the given proportions.

II. The author points out the various advantages to be derived as regards cost of production and increase of egg-laying, from feeding poultry on locusts or locust meal. The meal is not costly to manufacture and is easily prepared, the locusts being collected in sacks, scalded, dried in the sun, and reduced to powder, which is then mixed with dry food at a rate not exceeding 5 ½ %.

Comparative nutritive value of locust meal.

Foods	Protein	Moisture	Carbo-hydrates	Fat	Fibre	Mineral matter	Nutritive ratio
Locust meal	59.60	9.05	3.78	11.19	11.26	5.12	1 – 0.5
Meat meal	71.20	10.07	0.30	13.70	11.26	4.10	1 – 0.4
Fish meal	48.40	10.80	0.30	11.70	11.26	29.20	1 – 0.5
Fresh milk	3.40	87.10	4.75	3.90	11.26	0.75	1 – 4.0
Skimmed milk	3.57	90.50	4.95	0.10	11.26	0.78	1 – 1.4

P. D.

87. **Slaughter-House-Blood in Animal Feeding.**

C. V. *Revue de Zootechnie, La Revue des éleveurs*, Vol. 3, No. 9, pp. 164-165. Paris, 1924.

Blood, because of its constituents, is representative of the animal organism and because of its wealth in nitrogenous matter can, as a food, be of great service in cases of intensifive production. On the other hand, it is liable to promote disease, putrefies rapidly, and is very difficult to preserve.

Dr. GAUDUCHEAU makes the following suggestion for the treatment of blood: Vinegar and sugar should be added at the time of collection at the slaughter-houses, also an alcoholic yeast (Saccharomyces) should be mixed with it, and the blood should then be kept at the most suitable temperature for preservation.

Active fermentation starts at once, producing a substance of distinctive and pleasant taste, and having satisfactory preservative qualities. As there is no heating, the contained protein, diastase, and vitamins remain intact.

Blood treated in this manner is a satisfactory product and very nutritious. Young rats fed on it in the proportion of 1 to 20 in their daily ration, developed two or three times more rapidly than others not so fed, their increase in weight was 20 to 30 gm. per head and per day, whereas that of the others was only 10 gm.

It should be noted that the stimulating action on growth does not continue after the first week, but the progress achieved is maintained; this is easily explained by the fact that, when blood has supplied a sufficient quantity of amino-acids, iron and vitamins, that were lacking, or were present in insufficient quantities in the ordinary ration, its use ceases.

P. D.

88. Effect of Climate on Fecundity.

WOLDA, G., Akklimatisierung und Deklimatisierung. *Genetica*, Part V, Nos. 5-6, pp. 497-526, tab. 2. The Hague, 1923.

The varying fecundity of individuals is affected by climate and growth factors, which have also given rise to differences among the various species. This is particularly well-known in the case of birds and may be studied ecologically. A species which prolongs its laying period becomes acclimatised, one which shortens it becomes declimatised. The variation in the number of eggs laid is in its turn related to the longer or shorter laying period, which in turn is related to the more or less complicated structure of the nests.

The Author is also trying to discover whether in correlation with age. there is not also in the human species a different periodicity in births.

G. B.

89. Sex of Long-Carried Calves.

HOOPER, J. J. (Kentucky Experiment Station). *The Breeders' Gazette*, Vol. LXXXVI, No. 13, p. 281, Chicago, Ill., September 25, 1924.

It is a widespread belief among farmers that male sex is predominant among long-carried calves.

In order to reach a definite opinion on this point the author has studied the records of the Kentucky station herd with respect to about 500 pregnancy periods noted during the last 30 years; 44 cases out of this number exceed the normal period of pregnancy (283 days), by 7 to 17 days,

and of the 44 long-carried calves born, 25, i. e., 59 %, were males and 19, i. e. 41 % females. This would therefore be a ratio of 4 females to 6 males.

P. D.

90. Cross-breeding of the First Generation in Poultry-Rearing.

LEGENDRE, G. *La Revue de Zootechnie*. (Stock Breeders' Review). Year 3, No. 8, pp. 144-148. Paris, 1924.

In poultry farming it is not the laying of eggs alone that provides profit. Numerous factors contribute to it, amongst which should be named, besides abundant egg-laying during the winter season, early development, sexual precocity, size of eggs, vitality of embryos and young birds, adaptability to various external conditions, ability to obtain nourishment from the food supplied, etc.

Mixed breeds, therefore, undoubtedly possess valuable qualities, especially in regard to the last features.

In order to bring about an equal distribution of the qualities pertaining to pure and to mixed breeds, cross-breeding in the first generation has been resorted to, known as "industrial breeding".

In the case of poultry, the results shown by such first cross-breeding are as follows:—

Egg-laying:—

(1) The hybrids obtained by crossing two breeds often prove more prolific than their parents, an increase of 10 eggs per head per year can be attained.

(2) Whatever may have been the vitality of the breeds crossed, the hybrids' eggs show better fertilisation and less waste. There is also a decrease in the death rate during rearing.

(3) Precocity is greater; young cocks reach market weight a week earlier than those of pure breeds, which results in greater economy of time, labour, and food.

(4) It is understood that owing to theirgr eaterv itality and greater fecundity, hybrid hens can be kept to advantage for longer periods; hence a further economy is effected as regards egg-laying and the care of birds reserved for reproductive purposes.

	Pure Breeds	Cross-breeding of First generation
Fertility of eggs	80-85 %	85-90 %
Hatching as per fertile eggs.	70-75 %	75-85 %
Death rate during rearing, up to period of egg-laying in relation to birth rate.	25-30 %	15-20 %

(5) In some cases, in special crosses, it is possible to select, with a fair degree of accuracy, the male and female birds at the time of hatching. This allows of immediate treatment according to their different requirements, fattening for the market, or egg-production.

However, the crossing of breeds of the first generation also presents serious disadvantages; this has been proved in actual practice.

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(1) The tendency of hens to sit is greatly increased. In order to obtain a regular output of eggs it is important to prevent them from sitting immediately the tendency is shown.

(2) It is necessary to keep two pure-breed pens, of which one should be larger than the other : the one for the cocks should be the smaller as very stringent selection cannot be so easily followed.

(3) The only remunerative sale is that of selected fowls or sittings of eggs from the two pens of pure-bred fowls.

In practice crossing can be effected by three diffe1ent methods :

(a) *Cross-breeding of two light breeds*, producing hybrid hens of maximum sexual precocity, that may hatch late in the season, when egg-laying is abundant and temperature favourable to rearing. This method is best suited to specialised production of eggs.

(b) *Cross-breeding of a light breed with a heavy breed* :— In this case, the cock is taken from the light breed, so that the hens are not injured. A special feature of this form of breeding is the particularly rapid development of the young cocks, which inherit the mother's strength ; the young hens will on the contrary, inherit from the cock's side. The young birds in this case will be heavier, and will require more feeding than in the first instance, but will possess the maximum of qualities sought for in poultry-farming.

(c) *Cross-breeding of two heavy breeds.* — Minimum advantages to be obtained.

After study of the practical effects of the second method of crossing, the author is of opinion that it is too complicated, entailing considerable expenditure for installation, labour, etc.

In short, in spite of the real advantages to be derived from the crossing of the first generation, it would seem that the actual money return is higher from well-tended pure breeds. P. D.

Special.

91. Improvement of Milk Production by Cow-Buffaloes

MAYMONE, B. Il miglioramento dell'altitudine alla produzione del latte nei bufali. *Rivista di Zootecnia*, Year I, No. 9, p. 262-276, fig. 8. Portici, Italy, 1924.

The principal economic function of the buffalo is milk production. The milk is very different from that of the cow and is well adapted for milk products for immediate consumption, easily digested, rich in lactic bacteria and suited to the diet of persons suffering from intestinal troubles.

From the earliest times the buffalo has been selected empirically with a view to increasing the milk yield, the average annual production being about 100 l., without including that taken by the calf. The milk has an average fat content of 7.80 %, varying from 5 % at the beginning to 12.50 % at the end of the lactation period. Consequently this milk is twice as rich and gives a yield in by-products double that of cow's milk.

An average of 22 kg. of fresh "Mozzarella" is obtained from 100 litres of buffalo milk.

The external characteristics of milk capacity are more difficult to estimate in the case of buffaloes than cows on account of the great uniformity of all the members of the same herd, this being the result of inbreeding for centuries, and also on account of the thick-set body and coarseness of the skin. Neverthless, the general form of the body, the great development of the thorax and abdomen, combined with a docile nature, a black glossy skin with violet-red tones at the perineum and mammary region, a well-developed udder with a wide base, a fine mammary tissue folded when the udder is empty, less development of the muscular mass and a certain fineness of the skeleton, are characteristics of a good milk producing capacity. The striking disproportion between the fore-quarters and hind-quarters of highly-productive cows is not met with in cow-buffaloes. Moreover, preference has always hitherto been given to short-bodied rather than long-bodied animals, like the improved cattle; since 1921 the "Cattedra ambulante di Agricoltura" at Salerno has carried on a campaign against this tendency and attaches great importance to the length of the body.

Buffalo milk production is influenced by numerous factors, some depending on the individual, others on the surroundings; but the most important factor is feeding and, as the animals are reared in a wild state, they are hardy. The cow-buffalo prefers abundant green food, but does fairly well on the wild marsh flora. The natural dry prairies give the best results and the opinion is mistaken that the marsh pastures are best for grazing buffaloes. Milk production depends very greatly on feed, as is well known by breeders.

Season conditions are also an important factor and severe cold has a very marked depressing effect on production.

Individual differences in production are very great. The author puts the maximum production at 1548 kg. of milk and the minimum at 667 kg., for buffaloes given the same feed. RODDEMBERGER at Szász Feneser (Hungary) puts the average annual production of 42 buffaloes at 1036.5 kg. per head, with a maximum of 1853 kg. and a minimum of 482 kg. The cause of these partly hereditary individual differences is unknown, but a prominent factor is the duration of the lactation period, which is much shorter than that of the cow.

The cow-buffalo at the period of its first calving produces a smaller quantity of milk than adults, and production increases with each successive calving up to the 15th year. All other conditions being equal, milking twice a day instead of once may exercise a certain influence on individual production. TATCHEFF reports having obtained an increase of 28 % from individuals by milking 3 times a day. Breed is also an important factor in milk production, as is shown by the tests made by W. SMITH at the "Military Dairy Farm", Kirkee (Bombay Presidency, India), with 48 cow-buffaloes in the first calving period, of the *Gujerati* or *Surti*

(1) See *R.* March, 1919, No. 341 (*Ed.*).

breed (1). The first gave an average yield of 1253 kg. of milk per head containing 8.40 % of fat, and the second 1138 kg. of milk with a 7.50 % fat content. With regard to variations in the quality of buffalo milk, the greatest differences are in the fat content, which generally varies very widely between individuals and in the same animal throughout the lactation period.

Von ROSEMBERGER, analysing the milk of 25 cow-buffaloes periodically to determine its average fat content during the whole period of lactation, found, under equal breeding and feeding conditions, individual differences of from 6.60 % to 8.10 %. In one and the same individual variations in fat content during the lactation period are still more marked, being from 5 to 9-10-12 from the beginning till the end of lactation, there being no close relation between the average and the maximum fat content

Besides individuality, age, period of lactation, milking, feeding, work, sexual intercourse and breed are factors which influence variations in buffalo-milk fat content.

The influence of the lactation period is very great. Buffalo-milk fat content is at its maximum at the end of this period. The product of the same milking also shows differences: the milk is poor at first, but the last portions are very rich. The milk given in the evening is generally richer than that of the morning, but the factor here is chiefly the lapse of time between the two milkings.

The influence of feed in buffalo-milk fat content is also very great; other conditions being equal, dry pastures exposed to the South give milk with a higher fat content than marshy or shady pastures.

As stated above, the " breed " factor also plays a great part in buffalo-milk fat content variations.

The whole of the foregoing shows clearly that the empiric selection hitherto practised by breeders has hardly given satisfactory results. Basing selection on a careful observation of production and utilising the best breeding bulls as long as possible, a genus type may eventually be found which will be the first of a new line possessing the desired characteristics in a high degree.

The choice of breeding cattle will be based on a testing at least once a fortnight of the milk production, the richness of this milk, the length of the lactation period and of the period of rest between successive lactations. Bulls out of cows thus selected, will be utilised as long as possible, in order to enable the breeder to judge of their propensity to transmit the desired qualities and ensure their permanency by close in-breeding. Pedigree bulls will be accustomed to work in order to render them docile and prevent them from becoming heavy and stiff.

To facilitate the work of selection, the author considers the economic possibility of replacing the system of breeding in a wild state by the half-wild or the stable system. From what has been done in this direction in Rumania, Egypt, Bulgaria, India and China, and from a stable breeding test in the province of Salerno with 10 cow-buffaloes in their first calving period, the author concludes that such an economic transformation in

breeding is possible. In this way, and by increasing the milk-producing capacity by crossing with the Indian *Gujerati* breed, higher yields will be obtained than those in the South given by cattle specially raised for milk production. P. D.

92. Milk Production of Water Buffaloes.

LEVINE, C. O. & TO, S. T. (Canton Christian College). *The Lingnaam Agricultural Review*, Vol. 2, No. 1, pp. 1-8, Canton, 1924.

Estimate of cost of water buffalo milk production in Canton district. The estimate was carried out at the "Canton Christian College", on 14 full grown buffaloes, the record of production dating from the time of freshening, or when the cows went dry, and continued for a period of 365 days. The authors examined successively the following :—

(1) *Feeding* consisted of concentrated foods and fodder. Concentrated foods were :— Rice bran, wheaten bran, broken rice, ground-nut cake and soy beans. The quantity of grain given the animals varied according to the state of the cow and the amount of milk produced ; an average of about 3 lb. of the grain mixture was given for each 4 lb. of milk produced ; the animals were fed twice daily, morning and night, at 5 o'clock. Sufficient water was added to the concentrated food to form a thick mash.

A certain amount of salt was given daily with the concentrates. Green grass cut from uncultivated land or rice straw was given the animals as fodder, four times a day and averaging 20 lb. of green fodder or 5 lb. rice straw. Cost of feeding averaged \$119.32 per head per year.

(2) *Man labour.* — Expense per cow, under this head, is estimated at \$64.00 per head per year.

(3) *Interest on capital and depreciation on cows.* — Average death rate of European cows is approximately, 27 %. At the station under observation the estimate is \$1,200 (1), i. e. 8 % of cost price of a good water buffalo milking cow.

(4) The authors next examine : (a) interest, repairs and depreciation of buildings and equipment, (b) fuel, (c) milk bottling, (d) miscellaneous items.

The cows were milked twice a day, the milk being weighed immediately after milking. A buffalo cow produces on an average 5 lb. of milk per day, but its milk contains about 3 ½ as much fat, and twice as much total solids as the milk of European cows.

The average milk production of the 14 cows was 1985.22 lb., containing 11.25 % of fat, a production on an average of 223.27 lb. butter fat per cow per year.

The average cost of feeding was estimated at 6 cents per lb. of milk, the total cost per lb. of milk being 17.7 cents.

This figure however is subject to considerable variation from one animal to another, according to the quantity of milk produced in each case.

P. D.

(1) \$ = Canton Tael.

93. **Influence of Different Oil-Cakes on the Fat-Content of Milk.**

LANZILLOTTI N. (Esperienze fatte presso il R. Deposito di animali miglioratori annesso alla R. Scuola di Zootecnia e di Caseificio di Reggio-Emilia). L'azione di differenti panelli somministrati alle lattifere sulle variazioni del contenuto in grasso del latte di vacca. *L'industria lattiera e zootecnica*, Year XXII, No. 6, pp. 85-87, No. 7, pp. 100-101; No. 8, p. 116. Reggio-Emilia, 1924.

In tests carried out to ascertain the effect of different kinds of cake on the fat-content of milk, the author used 9 cows of Swiss breed, divided into three lots of as uniform units as possible, with regard to age, pregnancy, number of previous periods of lactation, time of lactation, milk production, and live weight.

Before making up these lots the cows were placed under observation for ten days, in order to obtain information as to food consumed and variations in milk production.

The experiment occupied 58 days and was carried out on two lots, one of which was fed linseed-cake and the other sesame-cake; the third, control-group received maize-cake. The basal rations were the same for all three lots of animals.

Experimental periods.

Period of:	Time	Supplementary food supplied		
		1st group	2nd group	3rd group
Preparation	16 days	maize-cake	maize-cake	maize-cake
Transition	16 »	linseed-cake	sesame-cake	» »
Experiment	26 »	» »	» »	» »

During the periods of preparation and of experiment a daily analysis of milk was carried out, especially as regards fat, in order to ascertain the action of the various foods.

During the 10 days of observation, the daily basal ration consisted of 60 kg. of first-cut lucerne per head; this amount was later reduced to 55 kg., supplemented by 3 kg. of May hay. Later, 50 kg. of green fodder,

Chemical analysis of the three kinds of cake.

Kind of cake	Water	Digestive Matter			Cellulose	Ash
		protein	fat	nitrogen free extract		
	%	%	%	%	%	%
Linseed	11.22	32.45	8.9	31.35	9.15	6.93
Sesame	10.10	38.30	12.73	20.95	7.12	10.80
Maize	11.05	14.15	6.25	56.00	7.50	5.05

composed of lucern and maize was substituted, after which 50 kg. of green oats were given and later 50 kg. of green clover, always however with the addition of 3 kg. of hay.

The nutritive value in calories calculated according to the formula "C" (= 1.1 protein + N. free ext. + 2.44 fat), amounts to 372.[illegible] calories for linseed, 384.79 cal. for sesame, and 358.39 cal. for maize cake. The nutritive ratio therefore is 1 : 1.9 for linseed, 1 : 1.5 for sesame and 1 : 5.5 for maize cake.

A daily ration of cake was fed to each cow according to the live weight and daily milk production in each case

Quantity of cake given per head and per day.

Names of cows		Milk production	Live weight	Ration	
		kg.	kg.	kg.	
Lola . . .	Ist group	9.2	570	1.5	Linseed cake
Lisa . . .		11.9	510	1.5	
Flora. . .		16.2	625	2.5	
Leda. . .	IInd group	9.8	600	1.0	Sesame cake
Thecla . .		10.6	580	1.5	
Mithen . .		16.7	520	2.5	
Guldi. . .	IIIrd group	11.6	585	1.5	Maize cake
Viola . .		13.2	620	2.0	
Carmen. .		12.4	660	2.0	

If the nutritive ratio of lucern is taken as 1 : 2.6, that of clover 1 : 3.7, of green maize, 1 : 10.5, of green oats, 1 : 7.5, the cows fed on linseed cake received a ration the nutritive ratio of which possessed an average of 1 : 5.7 ; those fed on sesame, a ratio of 1 : 5.6, and those fed on maize, a ratio of 1 : 6.3. The author considers the proportions sufficient for maintenance rations and for production. The daily feed was divided into two meals and the animals were in the open.

During the course of the experiment the cows were weighed every five days and thus there was an accurate record of variation in live weight while they were fed on these rations.

A cow from the first lot and another from the second lot fell sick, owing probably to certain products of the linseed and sesame cakes not being sufficiently eliminated, and to too heavy feeding ; the two animals were taken out of the lots under test, and the daily cake rations were reduced to ½ kg. per head during the third period.

Milking took place at 5 a. m. and 5 p. m. regularly and was always performed by the same man.

The above constitutes a daily decrease averaging 2.2 kg. in Lot I, 4.8 kg. in Lot II and 0.3 kg. in Lot III; this is explained by the approaching period of lactation, as well as the approaching summer season, and should not be put against the productive value of the cake rations. The sudden variations in daily production may be explained by individual features.

Average fat content of milk per cow and per group.

Cows and Groups	Period I	Period II	Difference
	%	%	%
Cow Lola	3.5	4.1	+ 0.6
» Lisa	3.3	4.0	+ 0.7
Ist Group.	3.4	4.0	+ 0.6
Cow Leda	3.6	4.3	+ 0.7
» Thecla	3.4	3.5	+ 0.1
IInd Group	3.5	3.9	+ 0.4
Cow Guldi	3.7	3.9	+ 0.2
» Viola.	3.2	3.1	— 0.1
» Carmen. . . .	3.2	3.3	+ 0.1
IIIrd Group.	3.3	3.4	+ 0.1

Average milk-production per cow and per group.

Cows and Groups	Ist period	IIIrd period
	kg.	kg.
Cow Lola :	8.4	7.2
» Lisa	10.0	9.0
Lot I	18.4	16.2
Cow Leda	7.9	4.0
» Thecla	10.0	9.1
Lot II	17.9	13.1
Cow Guldi.	9.3	8.3
» Viola	12.3	12.7
» Carmen	10.7	11.0
Lot III	32.3	32.0

After taking into account the principal causes that might effect variations in of milk-fat, for instance, individual tendencies and the approaching period of lactation, the following conclusions may be drawn from the experiments carried out as above :—

(1) Cattle do not appear to like linseed and sesame cakes as much as maize cake and the former might therefore cause serious ailments if given in too large quantities.

(2) The three kinds of cake had no appreciable effect on live weight.

(3) On the other hand they have a favourable influence on milk-production

(4) Linseed cake increases the fat content of milk more effectively than maize cake ; sesame cake also increases fat, but in smaller quantity than linseed cake, though more effectively than maize. P. D.

[93]

94. The Influence of Pasteurization and Diet of the Cow on the Anti-Scorbutic Potency of Milk.

OLSON, M. T. and CAPELAND, L. (Dairy Husbandry Department, South Dakota State College, Brookings, South Dakota). *Journal of Dairy Science*, Vol. VII, No. 4, pp. 370-379, Illustrations. Baltimore, 1924.

Experimental work undertaken to ascertain the antiscorbutic value of various quantities of milk produced and treated as follows :—

(*a*) Milk of cows fed a winter ration of ensiled maize.

(*b*) Milk of cows fed a winter ration without ensiled maize.

(*c*) Milk pasteurized in bottles, by heating to 52.8°C for 30 minutes compared with fresh, raw milk, from the South Dakota State College herd.

24 guinea pigs were used in experiment ; the animals were quite young at the start of the experiment and weighed about 300 gm., and had been put on full diet before the experiment. Groups were formed consisting of equal numbers of males and females, uniform in all respects.

The maintenance ration consisted of crushed oats and good lucern forage, finely cut and steamed in a self-regulating apparatus for 30 minutes at a pressure of 15 lb. per sq. in. and then dried ; water and salt were added.

Basal ration only: 4 groups. . . . . Basal ration plus milk from the College herd pasteurized in bottles for 30 minutes al 61-63° C., then rapidly cooled.	2	guinea-pigs	30	cc. of milk,	per day
	1	guinea-pig	45	cc.	per day
	1	»	60	»	»
Basal ration plus raw milk from College herd	2	guinea-pigs	30	cc.	per day
	1	»	45	»	»
Basal ration plus milk from College herd	1	»	60	»	»
	2	»	15	»	»
	2	»	30	»	»
Basal ration plus milk from a farm herd.	2	»	15	»	»
	4	»	30	»	»
	1	»	45	»	»
	1	»	60	»	»

The College herd included animals of the 4 principal milking breeds, the Holstein predominating.

The diet consisted of oats, maize, bran, oil cake (4 : 4 : 2 : 1), good quality lucerne hay (later of secondary quality).

In addition, the cows were given ensiled maize of good quality, *ad libitum*.

The farm herd consisted of cross-bred Jersey cows, first generation.

Their ration included maize cobs, oats and good quality of lucerne hay, for which later red clover was substituted, then lucerne hay of second quality.

Analysis of milks used in the experiments :—

	College Herd	Farm Herd
Total solid matter	12.6 %	14.2 %
Fat	3.7 %	5.3 %
Total protein	3.3 %	4.0 %
Lactose	5.0 %	4.2 %
Ash	0.74%	0.75%

The guinea pigs, were fed twice a day and were weighed every 3 days. The animals were examined immediately after death.

In 5 graphs the authors show the results obtained and state the following conclusions :—

(1) The basal ration totally lacks " C " vitamins ;

(2) Pasteurization in closed bottles at 61°C. for 30 minutes decreases the percentage of " C " vitamins in milk.

(3) " C " vitamin in milk owes its origin to food.

(4) Ensilage of cut maize when the grain is glazed, but before desiccation of the lower leaves, considerably increases the anti-scorbutic potency of milk.

(5) A good quantity of ensiled maize contains enough " C " vitamins to allow for a sufficient quantity in the milk. P. D.

95. **Production of Cow's Milk with Antirachitic Properties.**

LESNE and VAGLIANO. *Comptes Rendus hebdomadaires des seances de l'Académie de Science,*, Vol. 179, No. 11, pp. 539-541. Paris, 1924.

It is known that the milk of certain animals lacks antirachitic properties and the authors have made experiments with a view to remedy this by modification of the cow's food.

An extract of 500 gm. of cod-liver oil was added to the daily ration of a healthy dairy cow ; the food was well assimilated ; the general health of the cow remained excellent, appetite increased and there was no digestive trouble of any kind ; the milk produced did not diminish in quantity nor show any difference in smell, colour or taste. The butter was of lighter colour, but was satisfactory in taste ; there was no difference in the quantity of butter-fat produced, which varied from 38 to 42 gm. per litre. Calcium content per litre = 1.23 gm.

Phosphoric acid (P_2O_5) = 1.40 gm. instead of the normal 0.4 to 0.6 gm.

The butter produced is rich in growth-vitamins (factor " A "). Young rats fed on husked rice, refined casein, yeast, and 3 % of butter from milk taken from a normally fed cow, increased in weight by 15 gm. in one month ; whilst those fed in the same manner, but with 3 % of butter from the milk of a dieted cow, increased in weight by 35 gm. in one month.

Butter made from the milk of a cow fed on cod-liver oil contained, moreover, anti-rachitic properties, for young rats of 30 gm. weight subjected to a rachitogenous diet but with butter from the milk of a dieted

cow, only showed on inspection 25 days later very slight rachitic lesions, while the majority of them displayed no traces of disease.

On the other hand, rats thus experimented upon whose diet included butter from milk of a normally fed cow suffered from rickets to a marked degree.

Butter from milk of dieted cows possesses curative qualities in addition: — young rats of 30 gm. weight were subjected to the rachitogenous diet for a period of 15 days, after which, butter from the milk of dieted cows was substituted in their ration for ordinary butter; they mostly regained their normal health on the 40th day, a few only still showed slight rachitic lesions.

The organism however does not retain the antirachitic factor: cod-liver oil absorbed by female animals during pregnancy, or during lactation, does not assure immunity for the young when later these are submitted to a rachitogenous diet.

In conclusion, it can be said that milk from dieted cows whose rations include a considerable quantity of cod-liver oil, produces a quality of butter richly supplied with glycerophosphates (lecithin) and with growth vitamins. Milk thus produced has both a curative and a preventive action on rachitis, as shown by experiments on rats. Such milk has a certain therapeutic value on infantile rachitis and its use is recommended for the feeding of children whose unhygienic surroundings predispose to rachitis.

P. D.

96. **Hog Feeding Experiments Involving the Use of Self-Feeders.**

LAGO, F. P. (Department of Animal Husbandry). *The Philippine Agriculturist*, Vol. XIII, No. 1, pp. 29-44, 5 Fig., bibliography. Los Baños, Laguna, 1924.

The author refers to former experiments that have proved the economic value of self-feeders in hog feeding.

Details are then given regarding experiments carried out with the following aims in view:—

(1) To determine the relative values of sweet potatoes, cowpeas and mangoes, together with concentrated food such as maize, rice-bran, and coconut-cake, placed in a self-feeder and at the disposal of the animal;

(2) the relative value of maize, coconut-cake and rice-bran placed in the self-feeder at the disposal of the animal, with roots in both cases;

(3) the relative advantage of self-feeders and hand feeding, using maize, rice-bran and coconut-cake in the self-feeder, at the disposal of the animals and that of the same concentrated foods fed by hand according to the modified WOLFF-LEHMANN standard;

(4) to ascertain if the addition of dried shrimps, as animal protein in the rations, is advantageous in fattening hogs, with sweet potatoes as vegetable feed.

In order to carry out these experiments the author used Berkshire-Jalajala cross-breds and three Berkshire-cross hogs. In forming the

groups for experiments, the greatest possible uniformity was obtained with respect to age, weight, sex, breed, development, etc.

The animals were weighed separately for three consecutive days at the start and at the end of the experiment, as well as every 10 days during its course, between the hours of 7 and 10. The animals were constantly and amply provided with water.

The author gives details of the experiment grouped in 5 tables, from which the following conclusions are drawn :—

(1) Under the conditions of the test, for fattening hogs for the market, which received by means of self-feeders a ration of maize, rice-bran, etc., coconut-cake, potatoes and cow-peas proved to be of about the same value.

(2) As basic foods for fattening hogs for market, maize proved of greater advantage than rice-bran. In both cases the feed was supplemented by coconut-cake and sweet potatoes.

(3) The results obtained favour the use of self-feeders in place of hand-fed rations based on the modified WOLLF-LEHMANN standard.

(4) The addition of shrimps to rations, in order to provide animal protein has not proved advantageous for fattening of hogs for market.

P. D.

Poultry, Apiculture and Sericulture.

97. The Effect of Cold on Germination in Eggs.

MAURO, F. *La Revue Générale du Froid et des industries frigorifiques*, Year 5, Vol. V, No. 8, pp. 274-275. Paris, 1924.

M. E. Mancini has already discovered that a temperature of 7-10°C. below zero, maintained for about 2 hours, is sufficient to solidify the contents of an egg without having any effect on the vitality of the germ, or its capacity for subsequent development.

The Author undertook to carry out experiments of the same kind and was assisted by Prof. Dr. A. FIORENTINI and Dr. FENAROLI.

The test was carried out on five lots of 10 eggs ; the first lot was placed in the refrigerator, and kept at an even temperature of 0.5°C., whilst a second lot was kept at a temperature of 14°C. ; ten days later, the two lots were taken out of their respective sections and placed in the incubator after an interval of 24 hrs., so as to avoid too sudden a change in temperature. Seven days later it was noted that the germ development of the eggs kept in the refrigerator was less advanced than in the second lot. The first chicken was hatched in the incubator after three weeks, from the lot of eggs that had been kept at a temperature of 14°C. After 24 hours of incubation, the eggs of the first lot showed no results, whilst of ten eggs of the second lot results were positive in the case of 6 and negative in the case of 4 eggs. A 3rd and a 4th lot were allowed to remain for a period of 20 days in the refrigerator and in the ordinary section.

After 18 days of incubation, the eggs of Lot 3 gave no results whilst out of the eggs of Lot 4, 4 gave positive and 6 negative results. A fifth

lot was allowed to remain 30 days in a temperature of 14°C. and showed after an incubation period of 21 days, completely negative results.

A counter-test was carried out on 45 eggs : 5 were kept for 48 hours at normal temperature and then placed in the incubator. The other 40 had, on the previous day, been placed in the refrigerator. On the day the first 5 eggs were placed in the incubator, a first lot of four eggs were taken out and these, 24 hours later, were placed in the incubator ; on the following day the same course was followed with another lot of four eggs, and so on. On the 11th day after the introduction of the last four eggs in the incubator, a general inspection was made. The germ in the five eggs that had been kept at a temperature of 14°C, for 48 hours, had developed normally ; in three of the eggs of the first lot development was normal ; in the fourth, rudimentary. In one of the four eggs of the 2nd lot, development was normal ; in another, hardly perceptible, and in the last two, nil. From the third lot onwards there was absolutely no development.

It follows from the above that, in the case of eggs kept at a normal temperature, 100 % hatching is obtained from eggs kept for 2 days ; 60 % from eggs kept 10 days ; and 40 % from eggs kept 20 days, while in the case of eggs placed in the refrigerator at a temperature of 0.5°C. the vitality and capacity of development of the germ are considerably reduced after 48 hours, and entirely destroyed after 72 hours., whilst a period of 24 hours. in the refrigerator has no appreciable effect. It is moreover proved as regards fecundation that, while it influences the conditions of eggs during the time they are kept at a relatively high temperature, if once they are placed in the refrigerator, its action is annulled after a comparatively short period.

The varying behaviour of the eggs does not depend on the actual length of time of keeping in the refrigerator, but on the condition of the eggs, their comparative freshness, and the stage of development which they have reached at the time they are exposed to low temperatures. It is therefore important to submit eggs to careful examination before placing in the refrigerator.

P. D.

98. **Broodiness and Egg Production.**

VOITELLIER, CH. *La Revue Avicole*, Year 34, No. 10, pp. 289-290. Paris, 1924.

Breeders are generally agreed that broodiness among hens is not favourable to egg-laying.

A broody hen does not lay eggs ; while sitting it does not lay and after sitting, it is physiologically unable to lay eggs for a long period. The author refers to the results of several recent experiments on this question. Hens becoming broody four or six times during the year have laid more eggs than those that did not display the same degree of broodiness. In [illegible] Goodale established that there could be no positive connection between the amount of time given to incubation and annual egg production.

In an experiment dealing with 152 fowls of heavy breeds (88 white Wyandottes, 16 buff Orpingtons, 16 white Orpingtons, 16 fawn-coloured

Rocks, 8 Rhode-Island Reds and 8 red Sussex), the results in relation to broodiness are summarised up as follows :

	Eggs	Average production
Hens showing no broody propensity :	26	150
» ready to sit once :	10	172
» » twice	14	187
» » 3 times	14	182
» » 4 »	19	174
» » 8 »	7	166
» » 10 »	8	164

A group of buff Orpingtons (in which a total of 37 instances of broodiness had been noted), gave an average production of 178 eggs per hen ; one of these, whose recorded sittings amounted to ten, produced 176 eggs.

It should be noted that in these cases the propensity to broodiness was hindered by the fact that the hens were placed in open coops and that, if checked, a hen often exhibits the desire at fairly frequent intervals. Moreover the tendency to broodiness is only shown by birds that have already laid a fair quantity of eggs.

According to the author the direct causes of broodiness are not yet known ; the tendency is not permanent, it is displayed at constant and regular intervals in wild birds, after a certain number of eggs have been laid, but is very irregular in domestic birds owing to the modified functioning of the ovary, a result of intensive feeding and other causes.

Although it is difficult to modify the existing relation in a breed between laying and broodiness, and as the initial cause of broodiness is admittedly the laying of eggs, there is a risk that, in trying to do away with the first, the second might be decreased. A competent breeder should be able to attain his aim, if it were proved that the persistence of broodiness is really detrimental to great production, considering that races and species of varied tendencies have been produced by natural development. P. D.

99. **Apiculture in Poland.**

MALACHOUSKI, de A. *L'Apiculteur*, Year 68, No. 10, pp. 310-313. Paris, 1924.

Although it is impossible to give even approximate figures as to the quantity of hives and the number of apiculturists, it may be said that apiculture is a natural taste among the large proprietors, farmers and peasants in Poland.

In recent times preference has been given to the *Dadant* hive ; the *Lewicki* hive, however, of which the author gives a detailed description, is also used in Poland, and is well adapted to the climate and easy to manipulate. Many hives, constructed of wood, without frames, and straw hives, are also found, and even the tree-trunk hive is widely used.

As regards bees, besides the native species there are many imported Italian varieties and also the Caucasian variety, but the Italian are the best

producers. No one in Poland troubles about producing queens for the market, so that to have pure-breds, they must be imported.

The production of honey is fairly plentiful, this being due to the existence of acacias, lime-trees, fruit-trees, buckwheat and white clover, but few melliferous plants are grown. As regards swarming, it is mostly done naturally, except in the modern frame hives, where artificial swarming is often practised. The Gardening and Apicultural Society, which supplies a staff having the necessary technical knowledge, is at Warsaw.

Wax honeycombs, and a large part of the apicultural material, are manufactured in Poland; frame hives are left in the open air during the winter; those made of boards are kept in sheltered places or in cellars, where however rodents work havoc among them.

The principal yield of honey is in June-July, and the honey is sold in a liquid state, so as to preserve the wax of the combs, which fetches a high price. The yield is good and the honey of superior quality, except that gathered from heather, which is dark and of a disagreeable flavour.

In addition to honey, fruit wines with a honey basis and of very fine flavour are prepared; much gingerbread is also made in Poland. The peasants make a kind of mead from honey, which ferments very quickly, may be consumed after fermentation, has an agreeable flavour and contains about 1 % of alcohol. Adulterated honey is hardly ever to be found in Poland.

The people use agricultural material as little as possible, owing to the cost. Honey and wax are sold at very high prices. The world war has stopped progress and ruined many apiaries. A Lewicki hive at present costs 120,000 Polish marks (30 frs). P. D.

100. **Investigation on three Silk-Producing Lepidoptera in French Guinea.**

FLEURY, P. *Bulletin du Comité d'études historiques et scientifiques de l'Afrique Occidentale française*, Vol. VII, No. 1, pp. 39-49. Gorée (Senegal), 1924.

The author has had an opportunity of observing some silk-producing insects in Guinea and gives information on three principal species.

The first species belongs to the *Liparidae* family, *Coenostaegia* genus, of which two different types are found, one in October and the other in May, which leads the author to believe that there must be two generations presenting a seasonal dimorphism, the more so, as the cocoons from which the individuals hatch out are identical. The caterpillars live gregariously and weave large silk pouches, firmly attached to the branches, within which they pass through the chrysalis state in little isolated cocoons, pressed one against the other. They feed on several trees, but especially on the "toloqui", sometimes on the "kokoni" or "condou", on the "tourabo kata" and rarely on the "kantigui". The author describes these caterpillars, known in Guinea by the name of "toliqui", and the male and female butterflies, as well as their mode of life and evolution. The silk pouches are of various forms and colours; the isolated cocoons inside them are identical, whatever the form and colour of the envelope. The silk, glassy and flexi-

ble and soft to the touch, seems strong, and each cocoon contains a fair quantity. The zone inhabited by the genus *Cocnestaegia* seems very extensive and the author thinks that it extends also to Casamance and Dahomey. The cocoons are easy to unwind and contain silk of a fine colour; they are connected one with another by a fine silk floss, which may also be utilised. As to the pouches, it is useless to attempt to unwind them, for they are composed of a very close tissue containing several successive envelopes. They might be employed to make a rougher and coarser floss than that in the cocoons.

The second species is *Epiphora Beauhiniae*, belonging to the *Saturnidae* family. The author describes the caterpillar, its stages of evolution, and the butterfly which hatches from it. The caterpillar weaves a cocoon of silvery, greyish silk. The silk produced had not yet been utilised owing to the intercrossing of the threads at the network of the opening which was a rather serious impediment to unwinding. A solution for this has since been found; but the species is especially interesting on account of the silk floss. The zone inhabited and the dissemination of this silk-producing insect are very extensive; the author has met with it in the Soudan and in Guinea, where the caterpillar, which is very common, lives on the jujube-trees; it has been reported by A. SCHULTZER as living in the Cameroons, Amadua and Bornu.

A third species has been met with by the author in Upper Guinea: *Chrysopsyche imparilis*, of the *Lasiocampidae* family, allied to the *Borocera madagascariensis*. The caterpillar is vigorous, lives on the "Diamba-Cotton" (*Terminalia maeroptera*), is common in all seasons and lives perfectly well in captivity. The author describes the caterpillar and the male and female moth.

In its last stage the caterpillar weaves a cocoon of a fine golden colour, due to a liquid ejected by the animal, which changes into an impalpable golden yellow powder. By a judicious selection of the couples intended for reproduction, it is thought that finer cocoons could be produced.

P. D.

FARM ENGINEERING.

Hydraulics, Machines and Implements.

101. **Hydraulics and Soil Improvement.**

FORNARI, V. Le bonifiche idrauliche. Technical information and subjects for investigation, pp. 331. Rome 1924 (Published by Chierchia and Maggiorotti).

Engineer FORNARI'S work brings together the information on the benefits arising from hydraulics which is scattered in various reviews and publications. In setting forth the questions dealing more especially

with various systems for improvement, the author adds a description of seasonal torrent and permanent streams, which he places at the end of the article, both because swamps are often due to the action of natural water courses, and because a knowledge of this action serves as a guide, according to circumstances, for the improvements to be carried out and the constructional works necessary in connection therewith

Among other questions contained in these chapters on practical hydraulics on natural water courses and especially as regards improvements, the author gives the result of an investigation, from the hydraulic point of view only, of the possible consequences, downstream, of mountain reservoirs.

In this book will be found technical information and a development of hydraulic theories and calculations, treated in such a way as to meet the requirements of an enquiry on a work of improvement and to serve as a guide for the hydraulic work.

The original part by the Author is an analysis of the phenomenon of the coalescing of water sources and the method deriving therefrom, for making a forecast as to the maximum range to be assigned to the outflow of a basin to be drained. A. F.

102. Irrigation and its Practice.

I. Tennent, R. B and Marks, J. R. *New Zealand Journal of Agriculture*, Vol. XXVIII, No. 6, pp. 357-380, figs. 17. Department of Agriculture. Wellington, 1924.

II. *Ibidem*, Vol. XXIX, No. 2, pp. 108-118, figs. 15.

The authors describe the three main principles under which the natural moisture of soil may be supplemented, viz. : sub-irrigation ; standing water ; surface irrigation. The third of these methods, surface irrigation, is very fully dealt with under the following headings : Flooding from contour ditches ; flooding from field laterals ; the border-ditch system ; the border-dyke system ; the basin-check method ; wild flooding. The article concludes with a summary of initial costs, and expenses of upkeep of surface-irrigation methods.

II. — The authors continue the subject with descriptions of furrow and overhead pipe irrigation systems, and a discussion of the various implements required in the work. W. S. G.

103. Farm Implements and Machinery.

I. Buxton, The Right Hon. N. E. (Minister of Agriculture). Machinery on the Farm. *The Agricultural Gazette and Modern Farming*, Vol. C, No. 2645, p. 289 London, 1924.

II. Dunstan, M. J. R. (Principal, Royal Agric. College, Cirencester) Investment of Capital in Machinery. *Ibidem*, p. 291.

III. Modern Machinery for Farm Work. *Ibidem*, pp. 292-295.

IV. Dowling, R. N. Implements in the Development of Sugar-Beet Growing. *Ibidem*, p. 296.

V. KEEN, B. A. (Asst. Director, Rothamsted Experimental Station), Soil Tilth in Relation to Mechanical Tillage. *Ibidem*, pp. 297-298.

VI. DOCKERAY, R. Why Corn Growers should own a Thresher. *Ibidem* p. 298.

VII. MCHARDY, D. N. (Author of "Modern Farm Machinery") Tractors To-day and in the Future. *Ibidem*, p. 299-300.

I. — The author points out how the use of machinery may reduce the cost of particular operations on the farm, how time may be saved, or work done which it would be difficult or impossible to perform by horse or hand labour.

Attention is drawn to the new Institute of Agricultural Engineering at Oxford which has for its main objects, the study of farm machinery, the testing of new implements and the provision of instruction in agricultural engineering.

It is not considered that the extended use of machinery will in any way reduce the employment of farm labour.

II. — The author treats the subject from the economic standpoint and shows that the farmer to-day requires a larger amount of capital than in pre-war times, and that the amount of capital sunk in implements may easily be underestimated and needs very careful consideration. It is of no use saving time by the employment of machinery if the work of the farm is not so re-organised as to make good use of the time saved.

Some of the requisites for the satisfactory investment of capital in farm machinery are mentioned: The machine must be efficient; depreciation and wear and tear must be low; the period of the year when the implement can be used must be sufficiently long to justify its purchase; the implement must be in charge of a competent workman who is responsible for its condition and housing; the farmer, his son, or a responsible employer must have a working knowledge of engineering such as will enable him to detect the necessity for, and deal with "first aid" repairs.

III. — At the request of the Editor of the "*Agricultural Gazette*" a number of farmers have given accounts of their experience of particular machines when put to the test of actual use on the farm.

A Northumberland farmer after a long experience with a 10 h. p. Rotary Tiller, considers that it is probably the nearest approach to express production on the land that has yet been attained.

During the past four years a farmer in Wales, with its uncertain climate, has obtained the maximum amount of hay by employing tractor power for hauling and elevating his crop.

Another farmer describes the advantages of a tractor-drawn double-disc harrow in the making of a fine seed-bed, and in the making of a good mulch to keep the land moist in a dry season.

A Berkshire farmer considers that, on his 40 acre farm mechanical power saves at least £100 a year.

A Hertforshire agriculturist alludes to the fundamental importance of a constant and assured water supply on a farm, and how this may be obtained by the employment of a modern wind-power engine.

The use of the tractor, oil-engine and binder in all schemes of modern farming is emphasized by a Shropshire farmer, as also the employment of the sheep-shearing machine. But he draws attention to the fact that these entail more headwork for the master and that knowledge of machinery is necessary to keep them in order.

A Northamptonshire man has used the same tractor for seven years, on practically all farm operations, and has found it preferable to horses. The tractor is still in a sound condition.

A 4 unit milking machine plant has given satisfaction on a Cumberland farm, and enables from 24 to 30 cows to be milked by one man in one hour. The 4 unit machine and an 80 gallon per hour separator is driven by a 2-3 h. p. oil engine, which is also used for a turnip-cutter and to drive a dynamo for lighting the farm buildings.

The owner of two large silos, capable of holding 350 tons of silage, uses in connection with these, a tractor and cutter and blower for filling the silos. After the purchase of three tractors which proved to be unsuitable for his land, this farmer bought a general purpose light tractor in 1922, which has satisfactorily done the work formerly carried out by horses. The owner is convinced as to the utility of the modern light tractor. Other farmers also report favourably on the use of machinery, when properly managed, and one gives his experience of electric power for barn machinery; after ten year's use he states that it is the cheapest and best power for stationary machinery where the cost per unit of current is not too great.

IV. — The writer of the article on the use of implements in sugar-beet growing, R. N. DOWLING, is a recognised authority on the crop and his advice and hints should be carefully studied by all growers. Allusion is made to drills and drilling, horse-hoes and cultivators, digging implements, and also to steam and tractor power. He recognizes that reduction in the cost of growing is essential to the success of the industry and that such reduction can be effected by the intelligent use of implements, and of steam and tractor power where they can be economically employed.

V. — Valuable work has been carried out on the heavy soil of Rothamsted with the help of a dynamometer, which records the drawbar pull and speed of travel of the tractor, and when ploughing, the depth of furrow. The experience of this famous Station is that the tractor decreases the cost of work and gets it done in a given time; further, that high running expenses so often complained of, result from insufficient attention to the machinery. It was found that the resistance offered by the soil affects the speed of the tractor rather than the drawbar pull. The result follows that the power consumption *per acre* depends mainly on speed, or, the fuel consumption *per hour* is about the same whether the tractor takes 2 or 4 hours to plough an acre. Hence, time, fuel and wages are saved if the tractor is driven at as high a speed as is consistent with its construction.

As regards deep ploughing, it was found that the power consumption rose 100 % for a 6 inch depth of subsoiling in heavy clay.

Power consumption was found to be reduced as much as 15 % by chalking the land.

A reduction of friction on the mouldboard was obtained by electrical agency. If a current of electricity is passed though the moist soil from the coulter to the ploughbody, a film of water is deposited over the latter and acts as a lubricant. The laboratory results were confirmed in the field by the use of a tractor on which a dynamo was fitted.

Allusion is made by Dr. KEEN to the relative value of broken and unbroken furrows in reducing the work of subsequent operations, and the possibility of rotary tillage to produce a seed bed in a single operation.

VI. — Attention is drawn to the importance, on large farms, of the farmer owning his own threshing outfit, as in this case there is no delay in seasoning and thatching, and the grower of pedigree corn can clean the machine and so ensure the purity of his seed. For economical threshing it is essential to build stacks to contain a full day's work, in order to avoid the loss of time caused by moving and re-setting the thresher.

VII. — The author of "Modern Farm Machinery" discusses the effect of the War on the design and use of tractors, and the losses caused by purchase of unsuitable machines. Mention is made of the shortage of efficient drivers, that is, men with a knowledge of both engineering and farming. He considers that the four-cylinder, four-wheeled, light-weight tractor is a general-purpose machine, which, apart from minor improvements, will remain the standard type for many years.

W. S. G.

104. Artificial Drying of Crops by Hot Air.

The Field, Vol. CXLIV, No. 3748, pp. 636. London, 1924.

A process has been developed by the Institute of Agricultural Engineering at Oxford, which should enable farmers to secure undamaged hay and corn crops in spite of unfavourable weather. The crop is harvested as usual and, when possible, exposed for some hours previous to stacking. A circular stack is built round a central conical chamber, consisting of wire netting on a wooden frame. Hot air is then blown into the centre by means of a sheet metal duct from a heater in which atmospheric air has been made to circulate round red hot pipes. The hot air permeates the whole stack, the moisture is driven off as steam and after 9 hours a stack of about 25 tons is thoroughly dry.

Feeding trials will be made during the coming winter to compare the relative value of air dried and ordinary died products; it is estimated that the loss in nutritive value by the hot air method should be negligible.

The following comparative figures based on this year's trial demonstrate the economic advantages of the hot air process. When taken up on a commercial scale it is estimated that the initial outlay on apparatus should not be more than £50, exclusive of the tractor and other power unit.

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Haymaking per ton of green material.

	Cutting	Carting and Stacking	Artificial drying	Haymaking	Total Cost
	£ = s = d	£ = s = d	£ = s = d	£ = s = d	£ = s = d
I. *Good Season:*					
Artificial method	= 3 = 0	= 7 = 0	= 1 = 6	= = =	= 11 = 6
Ordinary method	= 3 = 0	= 6 = 0	= = =	= 4 = 6	= 13 = 6
II. *Bad Season*					
Artificial method	= 3 = 0	= 7 = 0	= 1 = 6	= = =	= 11 = 6
Ordinary method	= 3 = 0	= 6 = 0	= = =	= 9 = 0	= 18 = 0

M. L. Y.

AGRICULTURAL INDUSTRIES.

Plant Products.

105. The Cider Industry.

Le cidre. Production, Industries de transformation, Commerce. Paris, 1924, in octavo, 464 pp., with photographs. May be obtained at the " Syndicat général des cidres et des fruits à cidre ", 163, Rue Saint Honoré.

In May, 1923, the National Cider Week was held at Paris. Numerous parties interested took part therein, as well as several associations and syndicates.

The present volume contains reports of this Congress, which was divided, according to the subjects treated, into four sections. In the first were examined questions relating to the fruits used in cider making and an investigation of the scientific culture of the apple-tree, of the adaptation of the different varieties and their treatment. The Congress also investigated the control of apple-tree pests in which attempts have been made to utilise certain insects (*Hyponomeuta molinella* and *Eriosoma lanigerum*).

The second section dealt with the question of the cider industry properly so called : the manufacture, methods of control, importance of micro-organisms, cooling, various types of cider and advantages of perry.

The various subsidiary industries were treated by the third section, and included cider alcohols and brandies, the drying of fruits used in cider-making, the use of these in the manufacture of jams and jellies, the manufacture of vinegar and the utilisation of by-products.

Finally, questions relating to transport, trade and fiscal regulations were considered.

The practical conclusions arrived at by the Congress are: the improvement of orchards, the production of an alcoholic cider of standard type capable of being preserved and easy to transport, the development of subsidiary industries and the utilisation of by-products.

Those interested will find set out in this book the present position of questions relating to cider. A. F.

106. **Cider in France.**

" Annuaire de la cidrerie française ". Published by G. MALLET, p. 153, octavo, Paris, 1924 (Syndicat général des cidres et fruits à cidre; 163, Rue St. Honoré, Paris).

For many years the need has been felt in France of a publication containing commercial, technical and statistical information on apple production, cider and its by-products. This want made itself the more felt through the notable growth of the cider industry, as shown by the 1923 statistics, according to which 24 million quintals of apples, 19 million hectolitres of cider and 328,000 hectolitres of cider alcohol, were produced.

In the first part of this book, in which administrative questions are discussed, are given data on agricultural schools and laboratories, special instruction in pomology, legislation, fiscal regulations and conditions of transport. Some technical data are included which may be of interest, also statistical reports on production. In the commercial part the Statutes of the General Cider and Cider Fruit Syndicate and of the French Pomological Association are given, as well as a list of apple and cider producers. A. F.

107. **Production of Pentosan Adhesives and Furfural from Corn Cobs and Oat Hulls.**

I. LA FORGE, F. G. (Bureau of Chemistry, Washington, D. C.). The Simultaneous Production of Pentosan adhesives and Furfural from Corn Cobs and Oat Hulls. *Industrial and Engineering Chemistry*, Vol. 16, No. 2, pp. 130-131. Washington, D. C. 1924.

II. MAINS, G. H. and LA FORGE, F. B. (Bureau of Chemistry, Washington, D. C.). Furfural from Corn Cobs. *Industrial and Engineering Chemistry*, Vol. 16, No. 4, pp. 356-359. Washington, D. C. 1924).

Production of Pentosan adhesives. — If corn cobs and oat hulls be treated with super-heated water, solutions of pentosan adhesives are obtained. In this process, contemporaneously with the pentosans, other products are formed, the principal one being furfural. In the first tests it was sought to obtain the maximum yield in adhesive substances. Subsequently, in view of the fact that furfural is of some importance as an industrial substance, the investigators also tried to discover the best conditions to ensure an increased yield in furfural. The process treats, under proper pressure, raw material with water (1 part of material to 4.3 parts

by weight of water, at the surrounding temperature) and then successive concentrations (up to 28°Bé) are made of the gummy solution obtained. From corn cobs, by heating to 180°C. for 28 minutes, the yield in adhesive substances is 40-45 % and in furfural from 1 to 1.5 % of the weight of raw air-dried material. By continuing to heat from 7 to 15 minutes longer, the yield in gummy substances remained the same, but the yield in furfural rose to 2 %. If the heating be still further continued the pentosan adhesives quickly decompose with the formation of furfural.

With oat hulls the yield in adhesives is greater than with corn cobs, whereas the production of furfural is much less. By the same treatment as for corn cobs, and heating to 180°C. for 43 minutes, 61 % of adhesive substances and 0.73 % of furfural were obtained from oat hulls. If heating be continued up to 52 minutes the yield is 55 % of adhesives and 1 % of furfural.

The adhesive products obtained from these two plant offals are very small, sometimes that obtained from oat hulls is clearer and less hygroscopic than that obtained from corn cobs. One of the uses to which these adhesive substances may be put is for the substitution of sodium silicate in the manufacture of cellulose. Their widest and most promising use however is in the making of anthracite blocks, since the adhesive substances serve, as an excellent binder. The cellulose residue remaining after the process is also utilisable, either as fuel for the extraction process itself, or as raw material (replacing wood) for making cellulose pulp.

Production of Furfural. — Recently investigations and research work have been carried out with the object of obtaining cheap furfural from corn cobs. In fact during the last few years various ways of commercially utilising furfural on a large scale have been proposed. To mention only the principal, the authors draw attention to the following: (1) preparation of synthetic resins; (2) direct utilisation for fungicides and insecticides, (3) resin and varnish solvent; (4) utilisation as fuel.

The usual method of preparation is to treat the corn cobs with steam under pressure. The yield is greatly increased by adding a small quantity of sulphuric acid (the quantity corresponding to the basic content of the corn cobs) which acts as a catalysing agent. By adding sulphuric acid the yield in furfural rises to 9 % of the raw material (cobs), whereas, without the acid, the highest yield was 6 %.

To ensure a good commercial yield, the operations should be carried out on a large scale, and the authors report the examination (especially from the economic side) of a project for an installation capable of treating from 40 to 50 tons of cobs every 24 hours. From 3.5 to 4 tons of furfural can thus be obtained per day. This machinery should naturally be erected in districts producing a large quantity of corn offals. Thus, for the United States, the authors indicate as most suitable, some localities in the valleys of the Mississipi, Missouri and Ohio. The Authors then give detailed particulars of the estimated cost of production of furfural for an installation of the above-mentioned capacity. *The total cost of production according to the estimate given, would be 6.75 cents per pound of furfural produced.*

L. M.

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108. **Furfural.**

HARDY, Prof. F. (Imperial College of Tropical Agriculture, Trinidad). *Tropical Agriculture*, Vol. I, No. 10, pp. 158-159, bibliography. Trinidad, 1924.

Furfural is a plant product of coming importance which can now be manufactured at a low cost from the waste materials of various crop containing pentosans, such as maize cobs, banana stalks, cotton seed bulbs, sugar cane megass, kapok waste, and saw dust. The pentosan content of maize cobs is as high as 35 % and that of sugar cane megass 25 or even 31 %.

Chemically, furfural is an aldehyde, resembling in this respect formaldehyde, and was in the first instance prepared from bran.

Furfural can be used in place of formaldehyde as a fungicide or insect repellant. It is also employed in the manufacture of gramophone records and as a solvent for varnishes, and a new anaesthetic derived from furfural is being tested. There is every prospect of a large demand for this substance in the near future. W. S. G.

109. **Copra Industry and Methods of Drying in the Philippines.**

WESTER, P. J. Manufacture of Copra in the Philippines. *The Philippine Agricultural Review*, Vol. XVII, No. 2, pp. 101-108, plates 6. Manila. 1924.

Coconut growing has increased in importance in the Philippines in recent years and the number of trees planted has approximately doubled in the last ten years. It is noted, however, that a considerable economic loss has been sustained owing to the poor grade of copra produced, chiefly due to faulty drying and handling.

Experiments have been made to improve the methods of drying by the use of the sulphuring box, recommended as a cheap, effective and practicable preventative of moulds. Amongst recent inventions, the POLA copra drier has given satisfactory results and is fitted with a convenient tray shifting mechanism. The drier consists of a chamber containing several tiers of trays, placed above a boiler. The heat radiates from the boiler and passes upwards through the drying chamber (1).

The PATALON drier has also certain practical advantages as it is easily manipulated and well suited to small planters. Two arches are set parallel to each other at each end of the grill, and serve as furnaces which are fed from both ends. Five pairs of sheet iron flues are arranged to direct the smoke to two chimneys, one at each end of the brick flue. Two ventilators are so fixed as to prevent the accumulation of ash. The furnaces and intervening space are enclosed by a brick wall.

The copra is laid on the grill above the furnaces and flues, spaced so as to admit a free passage of heated air from below, without allowing the copra to fall through. The entries are placed on each side of the

(1) For a full description of the Pola drier, see *Philippine Agricultural Review*, vol. XVI No. 4. 1923. (*Ed.*)

chimneys. Uneven drying and other defects can be overcome by the use of brick flues or flues of heavy boiler sheet iron.

A description is given of the preparation of copra. It is estimated that about 200 nuts can be placed on 1 square metre of drying surface, and that the driers mentioned, operated 50 weeks in the year, are capable of treating 200 hectares of coconuts, planted 100 trees per hectare, with an average yield of 60 nuts per tree per annum.

Chopping the coconut flesh fine will hasten the drying, and trays have been found more practicable than the grill. M. L. Y.

110. **Cashew Nut Oil (*Anacardium occidentale*).**

GEORGHI, C. D. V. *The Malayan Agricultural Journal*, Vol. XII, No. 5, pp. 140-141. Kuala Lumpur, 1924.

Report of the valuation tests made at the Imperial Institute, London, with both crude and refined oils. Results show that cashew nut oil resembles almond oil in most of the constants, but that there is a distinct difference in the solidifying points of the fatty acids. It is estimated that after refining with soda and partially removing the stearine, cashew nut oil could be used as an edible oil, but it is unsuitable as a substitute for almond oil in pharmaceutical preparations. M. L. Y.

111. **Food Value and Economy of Ensilage.**

SHEEHY, E. J. and DELANEY, D. *Journal of Department of Lands and Agriculture*, (Ireland), Vol. XXIV, No. 2, pp. 117-130, tables 5, figs. 4. Dublin, 1924.

The authors' investigations were made at the Athenry Agricultural Station to ascertain the value of silage for stock feeding and the relative costs of production of equivalent food values of ensiled green food and mangels.

The conclusions reached were as follows:

The success of ensiling depends on the quality of the silage and this depends on the nature of the material ensiled, the time of cutting the crop and the method of storage. The storage chamber must be impervious to air.

Poor quality ensilage is unpalatable and acts adversely on the milk yield.

The experiments showed that 5 ½ lb. of silage is equivalent in food value to 10 lb. of mangels. The ration fed may be 21 lb. daily for calves and about 42 lb. for milch cows.

Silage is a suitable substitute for roots.

The cost of production is much less than that of mangels.

In the article other features are discussed, viz., the effect of legumes in enriching the soil, the possibility of securing a second crop from the same ground in one year, the increased corn production and carrying capacity of a farm on ensilage versus a root rotation. W. S. G.

112. **United States Grades for Hays, and Methods Essential for Marketing High Grade Hay.**

PARKER, E. C. (Bureau of Agricultural Economics), United States Grades for Timothy Hay, Clover Hay, Clover Mixed Hay and Grass Mixed Hay. *Dept. of Agriculture, Department Circular* 326, pp. 24, figs. 2. Washington, D. C., 1924.

Until recent years, standardisation in hay grading and marketing has never become nationalised and no serious attempt has been made to study the commercial value, with reference to physical characteristics. The Bureau of Agricultural Economics has therefore organised special investigations with respect to colour and foreign material as hay grading factors and with respect to mixtures and the varying percentages of clover and other grasses commonly found in timothy hay. Further studies have been made with regard to hay trade terms and shipping and market methods.

As a result it has been found possible to grade hay approximately by uniform methods. The author gives details of the recommended grade specifications for timothy and clover hay, and an explanation of the terms "class" and "grade"; colour requirements; foreign material; and a full description of the haymaking, baling and loading methods essential for the marketing of high grade hay, and the distinctive features of the classes and grades of timothy, clover, clover mixed and grass mixed hays. M. L. Y.

113. **Development of Fruit Preservation Technique and its Importance in Fruit Culture,**

GRAM, M., Frugtopberingstekinikkens Udvikling og dens Betydning for Frugtavlen. *Tidsskrift for Planteavl*, V. 29, No. 2, pp. 169-235, bibliography Konvn, 1923.

The author considers the phenomenon of fruit-ripening and the methods by which it may be arrested. The conditions for fruit-preserving ruling in various countries are studied and especially those relating to the transport of fruit in refrigerator cars and its utilisation in the manufacture of preserves. The advantages to fruit-culture of the scientific utilisation of fruit are shown. A. F.

114. **Transport of Citrus Fruits and Cold Storage Investigations.**

WAKEFIELD, F. W. Overseas Transport of Citrus. *The Fruit World of Australia*, Vol. XXV, No. 9, pp. 402-403. Melbourne, 1924.

Special investigations have been made by the Author in the interests of the Central Citrus Association, Victoria (Australia), to examine closely the conditions necessary for the satisfactory transport of citrus fruits from Australia. The Author bases his observations on a critical investigation of each controlling factor influencing stored fruits: specific resistance, gov-

erned by the position in the " Maturation Spectrum " ; wounds and abr sions of the skin ; conditions in a ship's hold, especially with regard humidity and temperature and the presence of vitally active spores.

The importance of attacking the problem from the standpoi of fundamental principles is accentuated and also the direct identificati of faulty consignments. M. L. Y.

115. **The Storage and Curing of Batangas Mandarin Oranges.**

DE LEON, J. *The Philippine Agricultural Review*, Vol. XVII, No. 2, pp. 10 108, plates, 6. Manilla, 1924.

A series of experiments on the storage and curing of the Batang mandarin orange were conducted at the Tananan Citrus Station (Ph lippines). An underground storage chamber was used, adapted to all the entry of a slow current of air and the exclusion of warm draugh during the day time.

Results may be summarised as follows :— the ventilated type underground storage is preferable to the unventilated chamber ; clipp fruits preserve less well than those gathered in the ordinary way ; th disinfection of fruit by immersion for 5 minutes in 0.018 % solution potassium permanganate before placing in storage, markedly improv storing quality ; the appearance and eating quality of the fruit improved by six weeks storage in the ventilated chamber, and successf storage is probable even for as long as eleven weeks. M. L. Y.

116. **Use of Ethylene in the Colouring of Citrus Fruit.**

CHACE, E. M., and DENNY, F. E. (Laboratory of Fruit and Vegetab Chemistry, Bureau of Chemistry, Los Angeles, Cal.), *Industrial and Engineeri Chemistry*, Vol. 16, No. 4, pp. 339-340. Washington, D. C., 1924.

The authors first consider generally the practice of artificial or forc colouring of oranges and lemons. This process, which may be consider " legitimate " only when applied to " healthy " or ripe fruit, has becom greatly extended, especially in South California. In many species of orang the degree of ripeness has absolutely no relation with the colouring ; the " California Valencia Orange ", which ripens in summer, is be better coloured in December, when it is bitter, than in the followi August, when it is completely ripe. Until a short time ago the syste of artificial colouring was by kerosene stoves only. The oranges we distributed in special rooms, called " colouring rooms ", in which we burning one or more open kerosene stoves, from which were given the products of combustion.

The desired effect is due to these products of combustion. Afte wards, after having analysed the gases given off by combustion, and hav repeatedly examined their properties, which are very similar to those ethylene, this gas was directly used. The result obtained exceed expectations. In fact, a minute percentage of ethylene in the air sufficient rapidly to convert the greenish colour of the fruit to yello

One part of ethylene in 1,000,000 parts of air produces in the same period the same effect as was produced by the stoves. Also one part in 5,000,000 of air produces a satisfactory effect, but in a much longer period.

In practice it has not been possible to use such low concentrations, but it has not been necessary to provide a greater concentration than 1 : 5000. It has been reported that better results are obtained by starting with an initial concentration of 1 : 20,000. The gas for this process is commercially available in cylinders. Ethylene will colour lemons with sufficient rapidity when the temperature is 60 to 70°F., and oranges at 70° to 80°F.

The use of ethylene is recommended for this process, as it is more convenient; the fire risk is reduced; the necessity for constant supervision is avoided; workmen are not exposed to the foul-smelling stoves; the fruit is never sooted from smoky stoves, and no odour is imparted to the fruit. The method can be standardised with respect to temperature, humidity and gas concentration in a manner productive of uniform results.

L. M.

117. Studies Relating to the Harvesting and Storage of Apples and Pears.

HARTMAN H., *Oregon Agricultural Experiment Station, Bulletin* 206, pp. 32, tables XXIII, figs. 2, bibliography. Corvallis, 1924.

Report of investigations made at the Corvallis Station in 1923, which include studies relative to winter varieties of pears and the handling of apples.

The author gives a short account of the pressure test of maturity, based upon the lowering of the physical resistance to pressure or wounding of the epidermal and cortical layers during growth and ripening. Reference is made to the full description of the " pressure tester " in the *Oregon Agricultural Experiment Station Bulletin* 186. This test is, however, materially influenced by several factors: temperature of fruit, turgidity, removal of portion of crop, russeting and colour effect.

The loss in weight after harvest, caused by humidity, aeration, temperature, time of picking, condition of epidermis and variety of fruit is fully discussed; also the general indication of maturity of the fruits and time of picking in relation to quality and time of ripening; number of pickings in relation to size and tonnage; utilization of night temperatures; red colour as an indicator of keeping quality; core rot associated with over maturity; the pressure test as applied to the apple, size and quality relative to picking time and bloom relative to loss of weight and keeping quality.

M. L. Y.

118. Loss in Weight of Stored Apples.

WATERS, R. *New Zealand Journal of Agriculture*, Vol. XXVIII, No. 4, pp. 268-269. Wellington, 1924.

Report of further investigations into the cause of apple flesh collapse and a study of the temperature humidity ratio. Experiments were made

286. **Great Britain.** *Fourth International Congress of Refrigeration, London, June* 16 to 21, 1924. — The Congress, officially supported by the Governments of 47 countries is recognised as the focus of Refrigerating Interests in relation to all industrial and scientific applications and to overseas traffic. H. M. Government is providing accommodation and giving a State Banquet to the Congress in London. Papers will be read on scientific questions, refrigerating materials, general applications, land and marine transport, legislation, education and propaganda, economics and statistics. Excursions to refrigerating and other establishments in London and the Provinces will be arranged. Particulars may be obtained from the Hon. Secretary-General, Mr. J. Raymond, Weaver's Hall, 22 Basinghall Street, London, E. C. 2. (*Cold Storage*, Vol. XXVII, No. 311. February, 1924).

The British Association for the Advancement of Science. — The date of the meeting at Toronto has been changed by the Council of the Association from September to August 6-13. The main party will leave England about July 25, and the excursion tour will be after, instead of before, the meeting. The British Association will meet at Southampton in 1925. (*Nature*, Vol. 112, No. 2824, p. 874. London, December 1923).

Textiles Conference. — Arrangements are being made by the Textile Institute of Great Britain for an Empire Textile Conference to take place at the British Empire Exhibition during Whit-week (7-14 June). The objects of the conference are :—

1) To promote the commercial, technical and scientific advancement of the industry.

2) To promote closer relationship with the various parts of the Empire.

3) To bring together representatives of the textile industry.

4) To discuss problems associated with the production of raw materials. (*South African Journal of Industries*, Vol. VI, No. 12, p. 563. Pretoria, 1923.

287. **Italy.** *Convention for Beet-Cultivation in Italy*, Bologna, January 18, 1924. — Reports were presented by : MUNERATI (Direttore della R. Stazione di Bieticoltura di Rovigo) dealing with the application of the contract from the technical standpoint. — MAROZZI, New Directions in Beet-Cultivation in Italy from the Economico-Social Point of View. — PRATOLONGO, Application of Potassic Salts and other Measures Adopted for the Improvement of Beet-Cultivation, etc. This Convention was organised by the Federazione Italiana, Sindacati Agricoltori (F. I. S. A.), Bologna.

Pomological, Viticultural Congress, and National Fruit and Table-Grape Show. Trent, October 1-12, 1924. Organised by the Trent Provincial Council of Agriculture.

National Italian Veterinary Congress, Pisa, October 8-10, 1923. On this occasion, Prof. CARLO BALDI of the Istituto Agrario Vegni (Le Capezzine, Florence), made an important communication respecting the treatment of foot-and-mouth disease by means of external disinfection with a 4 % solution of copper sulphate, and internal disinfection by the ingestion of a solution of methylene blue.

Convention for the Protection of Grana cheese, Bologna, November 17, 1923. — Arranged by the Federazione Italiana, Sindacati Agricoltori, Bologna.

Official reporter Prof. FASCETTI (Direttore dell'Istituto Sperimentale Caseificio di Lodi). The question of forming a Consortium among the producers of " Grana " cheese with the objects of protecting cheese manufacture; collecting information regarding the making and marketing of dairy products; the control production and trade; the improvement of cheese making technique etc.

288. **Holland.** *International Phytopathological and Entomological Conference* at Wageningen, *June* 24-30, 1923. (See *International Review*, Vol. I, No. 1, p. 257, 1923). — Various countries were represented and reports have recently been published and T. A. C. SCHROEVERS intends to mite these in one volume of about 300 pages, with 9 figures in the text and 18 coloured plates.

Amongst the questions discussed at the Conference, special attention was given to the diseases of potatoes. The diseases and pests of other cultivated plants and methods of control were also discussed; also the organisation and legislation concerning Phytopathological services and international collaboration. The " International Phytopathological and Entomological Committee " was formed with headquarters in Holland, with a view to the elaboration of suggestions put forward at this Conference and to collect all possible information relative to diseases and pests of plants and adequate means of control, taking into account the prevailing conditions in each country, etc.

289. **Philippines.** *Sugar Association.* — The first annual convention of the newly organised Philippine Sugar Association was held at Manila from October 6th to 12th. Reports were submitted by the different committees on cane diseases, cultivation, animal husbandry, mill data, sugar storage, manufacture of sugar and yields. Planters showed appreciation of the advantages of scientific agriculture.

There are now in the Philippines 32 large factories with a combined daily capacity of 24 970 tons of cane; the crop capacity of these 32 factories is given as 374 550 tons of 96 % sugar. The modern method of estate supervision is shown by the employment of the aeroplane for inspection work on large plantations. (*The Louisiana Planter and Sugar Manufacturer*, Vol. LXXI, No. 24, New Orleans, La., 1923).

Miscellaneous.

290. **Russia.** — *The Metric System to be officially recognised*, as from January 1, 1927. The introduction will be gradual, under the control of a special interdepartmental metrical commission. Since March 10, 1923, the manufacture, sale and purchase of old weights and measures have been prohibited. Arrangements are to be made for instruction of the population in the metric system. The Customs and other State institutions have been instructed to introduce the metric system. (*Nature*, Vol. 113, No. 2829. London, Jan. 1924.

291. **North Africa,** *Hydraulic mesures Algeria. Scheme for regulating the water of the Tafna basin.* — F. DOUMERGE describes a series of barrage-reservoirs that to be constructed for the systematic regulation of the waters of the Tafna and of its affluents (Algeria), in order to utilise for agricultural purposes the large volume of water which at present flows directly into the sea and is lost.

percentage rose to 52 %. In another case by reducing the speed of the machine 25 % the fat content of the cream fell from 54 to 26 %.

W. S. G.

123. Solubility of Milk Powder.

I. FOUASSIER, M. (Institut Pasteur). L'insolubilisation progressive des poudres de lait. *Le Lait*, Year IV, Vol. 4, No. 35, pp. 366-369. Lyons, 1924.

II. SUPPLER, G. C. and BELLIS, B. (of the Research Laboratory of the Dry Milk Co. at Adams, N. Y.). On the Solubility of Milk Powder. *Le Lait*, Year IV, Vol. 4, No. 35, pp. 358-366. Lyons, 1924.

I. Progressive insolubility as shown in certain milk powders shortly after their manufacture implies a serious change of condition in the powder which obviously reflects on its use and value.

The author in the course of his experimental work has observed particularly rapid insolubility in powders produced by the process of desiccation in which milk is poured so as to cover heated cylinders; while insolubility was reached very slowly and was almost imperceptible in powders produced by a process of spraying in heated chambers and preserved in tin boxes.

Under the microscope milk powder produced by the cylinder process or Powder "A", appears as amorphous masses varying in size, and with irregular outlines; it is coarse, and of rough texture, whereas milk powder produced by the spraying method appears as small rounded grains, very fine in texture and passing easily through the fingers.

In the cylinder process, the desiccation temperature reaches a maximum of 100 °C which affects the albumen but has little or no effect on the casein.

As regards acid content in milk, the author's observations show that milk powder produced from fresh milk of normal acidity gradually loses its solubility.

Various tests carried out by the author on Powder "B", gave the following results. The insolubility coefficient reaches a maximum but 5 % moisture is sufficient to start insolubility in the powder.

This progressive insolubility of milk powders is but a natural consequence of the precipitation of lactic acids on casein, a process which is greatly stimulated by moisture and heat. . .

The degree of moisture absorbed, or insufficiently eliminated during manufacture, is favourable to and may actually bring about the insolubilising action of lactic acid on the casein in the powder.

It is therefore of the highest practical importance to reduce the moisture content, at the time of manufacture, to approximately 3 %, and to maintain this percentage by suitable packing so as to secure protection against moisture in all forms through contact with the air.

II. Solubility in quite fresh milk powder varies according to the process of manufacture, according to the acids contained in the liquid milk used in manufacture, and according to certain conditions depending on the methods employed in the desiccation process. Another factor appears of

ter a certain time of storage, viz., that of the moisture content, either the moisture already contained in the powder, or that absorbed from the atmosphere.

The authors have carried out a series of special tests which have led to the following conclusions:—

There is a direct relation between the moisture content and the development of insolubility in the proteins of milk powder during storage. There is a complete absence of casein after treatment in the centrifuge under certain conditions, at the end of 7-8 weeks, during which 100 litres of moist air had been passed through the milk powder daily.

The moisture content of the powder increased from less than 2 % to approximately 11 %.

An identical capacity for moisture absorption and consequently, a similar development of insolubility of the casein is found in the milk powders obtained by the cylinder process as in those obtained by spraying.

Air freed from moisture passing through milk powder under the same conditions as moist air, effects no change in the solubility of the proteins during a period of six months. It appears that the proteins will maintain their original solubility as long as the powder is kept absolutely free from moisture. The original solubility of casein in milk powder can be maintained for one year and longer provided the absorption of moisture is less than 3 %. Samples with an average moisture content of 3 to 5 % and whose solubility showed but slight alteration in the course of a year, became almost entirely insoluble in the space of a few days when their moisture content suddenly rose to 6.5-7 %.

The product obtained after centrifugal treatment of milk powder (cylinder process) contains approximately 3 % protein and 7 % ash, consisting of calcium oxide, magnesium and phosphoric acid. Analyses show that insoluble calcium phosphate and undoubtedly also insoluble magnesium phosphate, are the chief ingredients in the mineral precipitate.

P. D.

PLANT DISEASES

Plant Parasites.

124. Plant Diseases and Pests observed in Denmark.

GRAM, E. and ROSTRUP, S., Oversigt over Sygdomme hos Landbrugets og Havebrugets Kulturplanter i 1922. *Tidsskrift for Planteavl*, Vol. 29, Part 2, pp. 236-309, figs. 2 Copenhagen 1923. (Received 1924).

The period of observation. (1 Oct. 1921 to 30 Sept., 1922) was characterised by a dry, sunny autumn, and frequent heavy storms and cold, dry weather in January and February, a late spring and very cold, wet summer.

Numerous slight and many serious cases of attack on barley by *Pleospora graminea* were observed; attacks by *Tilletia Caries*, on the other hand, were fewer, in consequence of the seed having been disinfected. Conditions favouring infection increased the attacks of *Ustilago Hordei*, *U. Avenae*, *Urocystis occulta*. *Heterodera schachtii* var. *avenae* caused much damage to oats. In Jutland, *Oscinis frit* larvae and in a lesser degree those of *Chlorops taeniopus* were unusually destructive. *Hylemyia coarctata* larvae renewed their attack on wheat after many years, and those of *Agriotes lineatus* proved more than usually destructive.

Vegetables, during the rainy summer, were seriously attacked by *Sclerotinia sclerotiorum*, *Ascochyta Pisi*, *Fusarium* spp. and *Botrytis*; *Macrosporium Pisi* was also abundant and in some places completely destroyed the crop. Very abundant *Biston zonarius* larvae appeared in a field of trefoil in July, which they almost completely devoured.

Repeated experiments proved that beet "mosaic", which appeared early and was very destructive, is not transmitted by the seed. *Hypochnus Solani* was very abundant on many crops, including the beet.

Phyllotreta nemorum and other Coleoptera of the *Halticidae* family, in many places necessitated a second sowing; tests by spraying with nicotine sulphate (0.1 %) and with lead arseniate (0.2 %) gave good results. *Ceutorrhynchus quadridens* larvae were rather destructive to mangels; the mangel seed crop and the product of other largely cultivated edible Cruciferae were to a great extent destroyed by *Meligethes aeneus*. *Chortophila brassicae* larvae, which were extremely destructive, were effectively combatted in the tests carried out with tarred paper discs and with two sprayings of 0.1 % solution of corrosive sublimate.

In Jutland, leaf curl of carrots caused by *Trioza viridula* was somewhat extensive.

Potato "mosaic", leaf roll and other virus diseases, showed great increase, apparently due to the warm, dry summer of 1921.

In some localities *Apamea testacea* larvae partially damaged *Festuca elatior* seed crops, as well as some fields of barley. The migration to the roots of Graminaceae by *Aphis fitchii* Sanderson was proved by tests.

Fusarium Willkommii, the conidial state of *Nectria galligena*, caused rot in apples and pears during storage; *Gloeosporium album* was also reported on the former. Attacks on fruit-trees by *Xyleborus dispar* were reported for the first time. *Hoplocampa testudinea* and *H. fulvicornis* larvae on apples, pears and plums were unusually numerous. The apple shoots in some places were attacked by *Blastodacna putripennella* larvae. Abundant *Carpocapsa pomonella*, *Olethreutes ocellana*, *Cheimatobia boreata* and *Ch. brumata* were also found on apples; the last-named was also found on the black currant.

Leaf spot caused by *Marssonina Potentillae* var. *Fragariae* were reported for the first time on strawberries. Strawberry fruits were damaged by *Mermis* sp., *Anthonomus rubi* did much damage to strawberries and in some places also to raspberries. Near Copenhagen *Acalla comariana* larvae were very destructive to strawberry crops.

In various places *Nematus ribesii* stripped the leaves from currant-

bushes; spraying with tobacco extract 0.2 % immediately killed recently hatched larvae.

During the wet weather beans were greatly damaged by *Glomerella Lindemuthiana*, *Sclerotinia sclerotiorum* and other fungi.

Phytophthora infestans on tomato fruits was effectively combatted with 2 % Bordeaux mixture *Verticillium albo-atrum* appeared in some places. *Cladosporium fulvum* was very destructive but was controlled by abundant ventilation and heating of the hot-houses during the night; better results were obtained with lime-sulphur mixture (1 : 40) than with 2 %. Bordeaux mixture.

Leaf spots due to *Phyllosticta Cucurbitacearum* were observed on melons.

Heterosporium Allii appeared on leeks.

Graphiola Phoenicis and *Exosporium Preslii* were found on *Phoenix* leaves. *Volutella ciliata* was noted on the dead parts of *Aspidistra*. *Dianthus* plants were damaged by thrips and by *Hylemyia cardui* larvae.

Very extensive damage due to frost was caused to certain varieties of wheat, especially if sown late, also to certain seed crops, roots and stored potatoes fruit-trees and shrubs and many ornamental plants.

The heavy autumn storms in 1921 caused much damage through the action of salt water.

Among the various insecticides tested, "Venetan" a nicotine soap, a mixture of soap and methylated spirits, "Belumnite", the "Apa-Fumus" bandages and nicotine sulphate proved more or less efficacious against various aphides.

Damage by spraying was caused to apples and roses by an application of 2 % Bordeaux mixture followed by 0.05 % aceto-arsenite of copper and on pears by 0.5 % formalin. A tobacco extract containing free ammonia caused all the leaves to fall. A. F.

125. **The Growth Reactions of certain Fungi with reference to their Excretory Products.**

BOYLE, C. *Annals of Botany*, Vol. XXXVIII, No. CXLIX, pp. 113-135, graphs 5. London, 1924.

The author has investigated the staling of liquid media, and has attempted to discover, how, and to what extent, the capacity for growth could be recovered.

A species of *Fusarium* possessing very active staling properties was used to produce the staling products. Cultures were made on Richard's solution, with normal and reduced phosphate, potato extract, and apple extract. The progress of staling was measured by the inhibitive effect of the stale liquid on the germination and growth of spores of *Botrytis cinerea*, since the spores of this fungus were much more susceptible to the metabolic products of *Fusarium* sp. than were the spores of *Fusarium* itself. The amount of growth of *Fusarium* sp. was determined by weighing the mycelial mat, and the hydrogen-ion concentration was ascertained by the colorimetric method.

Inhibition of growth in staled media was not due to lack of nutrient materials. The effect of boiling the staled medium was to restore its capacity for growth in the early stages, but the effect decreased as the medium became more stale. In all four media the fungus caused a decrease in hydrogen-ion concentration as the medium became increasingly stale. In the early stages of staling, readjustment of the pH value of the medium restored its capacity for growth. At a later stage however correction of the pH value had no apparent effect, doubtless on account of the presence of other inhibiting factors. Boiling and correction of the pH value had an added effect in promoting growth in a staled medium, when, separately they were ineffective.

Cultures of *Fusarium* sp. and *Botrytis cinerea*, on Richard's solution, apple extract, potato extract, and mannite of various reactions, showed that the pH limits and optimum for growth of the two fungi are not absolute, but depend on the medium on which they are grown. Since the medium is continually changing during staling, the pH limits of growth may alter in consequence, but within wide limits, the change in reaction is not, in all probability, a limiting factor for growth. C. B.

126. ***Cephalosporium Acremonium*, a Hyphomycete Harmful to Maize in the United States of America.**

REDDY, C. S. and HOLBERT, J. The black bundle disease of corn. R. *Journal of Agricultural Research*, Vol. XXVII, No. 4, pp. 177-206, figs. 4, tabl. 6. Washington, D. C., 1924.

The disease, described by the authors under the name of "black bundle disease of corn", has been observed on *Zea Mays indentata*, *Z. Mays indurata* and *Z. Mays saccharata*. The most characteristic symptom of this disease is the presence of black vascular bundles in the stems and sometimes in the leaves of maize. The following anomalies are found in a pronounced degree in connection with the disease: excessive production of offshoots, prolificity of the stem, which shows a tendancy to develop ears corresponding to numerous nodes, or to produce several ears united in a single bunch; the red or purple colour of the leaves and stems; stems with aborted ears; stems bearing imperfectly developed ears only.

The disease, which probably exists in every part of the United States where maize is cultivated, has up to the present been reported in the following States: Connecticut, New York, Ohio, Indiana, Illinois, Wisconsin, Minnsota, Iowa, South Carolina and California. The damage caused by it is considerable.

The Mucedinacea *Cephalosporium Acremonium* Corda has been found in close relation with the group of symptoms above mentioned; it has been isolated and cultivated on various media. The fungus has produced many of the said symptoms after being inoculated in pure cultures.

The disease caused by this fungus is transmitted by the seed. *Ceph. Acremonium* penetrates into the grain through the vascular system and lives there until conditions become favourable for germination. It does not generally impede germination, nor restrict early growth; the [illegible]

specifically attacks the development of the grain and towards the end of the growth period causes a general withering.

In reducing loss caused by this disease, the plants showing any of the symptoms in question should, above all, not be deprived of ears of which the seed is to be utilised for sowing. Probably the best means of combatting the disease will be the development of resistent varieties of maize. Preliminary tests, not yet completed, as to the treatment of seed for sowing, promise good results. A. F.

127. ***Phytophthora omnivora*, a Phycomycete injurious to the Pepper Plant in the Campania.**

TROTTER, A. « Cancrena pedale » del Peperone e Melanzana nella Campania (*Capsicum annuum* a *Solanum Melongena*). *Rivista di Patologia vegetale*, Year XIV, Nos. 7-8, pp. 125-130. Pavia, 1924.

For some years, here and there in the Campania, and especially in the Province of Naples, mlongena plants, and still more often pepper plants, already in the nursery or soon after transplanting, or also towards the flowering period, show signs of wilting especially in the afternoon, and then recover somewhat during the night, this continuing until they become completely yellow and dried up. Only a few of them, though drooping, survive flowering and fructification.

The stem, especially near the collar, appears considerably contracted and emaciated, the tissues down to a certain depth being browned, especially when the disease has reached its culminating stage. From the collar it tends to spread in an upward direction, and sometimes may even reach the juncture of the branches and advance along them. The roots appear to be normal.

The disease, to which the author proposes to give the name of " cancrena pedale ", is, in his opinion, exclusively due to *Phytophthora omnivora*, though associated with this Peronosporacea a fungus (*Fusarium* sp.) and a Nematode have been found.

Preventive means: 1) collect and burn the diseased plants; 2) renew the seeding plots, change their position where necessary or disinfect them, and apply, possibly, a mineral fertiliser; 3) disinfect the seed with a 1 % solution of copper sulphate and afterwards wash in lime water; 4) spray the seedlings, as soon as transplanted, with ordinary Bordeaux solution, and the seedlings in the nursery, in the last period, with a 5 % copper-lime solution; 5) if the infection is intense and widespread, temporarily replace the pepper plant and melongena crops by other plants known to be immune. G. T.

128. **" Vine Mildew " (*Plasmopara viticola*) Reported for the First Time on *Ampelopsis Veitchii* in Europe.**

LÜSTNER, G. Über das Auftreten der *Plasmopara viticola* Berlese et de Toni auf *Ampelopsis Veitchii* in Rheingau. *Nachrichtenblatt für den deutschen Pflanzenschutzdienst*, Year 4, No. 10, pp. 75-75. Berlin, 1924.

In the year 1924 – when there was a severe attack of *Plasmopara viticola* on the vines in Rheingau (Germany), combined with unusual

dampness — " mildew " was reported for the first time in that region on *Ampelopsis Veitchii*. The fungus appeared at the beginning of September only on the young leaves of the branch apices (the older leaves, on the contrary, remained immune) and caused spots, all of irregular shape, to appear on them, which spots, at first brownish green in colour and transparent, afterwards browned or reddened and dried. The white efflorescence which formed on the underside of the spots, was not so evident as in the case of the vine-leaves, but scarcer and more delicate; it became more accentuated after remaining in a damp room. A microscopic examination of the conidiophores forming the white efflorescence and of the fungus spores, showed that these organs corresponded, in shape and size, with those of *Pl. viticola*.

The presence of the fungus on *Amp. Veitchii* has already been known for some time in North America. Its appearance on the same plant in Europe may meanwhile, in the opinion of the author, furnish additional proof of the fact that the parasite is adapting itself more and more to the local conditions here.

G. T.

Animal Enemies.

129. *Tomocera californica* Hymenopteron parasitic on the *Coccidae Ceroplastes rusci* and *C. sinensis*, reported as new to Europe.

GARCIA MERCET, R. Pteromálidos de España (*Hym. Chalc.*). Primera nota. *Boletín de la Real Sociedad Española de Historia Natural*, Vol. XXIV, No. 9, pp. 421-439, figs. 4. Madrid, 1924.

This note contains more especially morphological descriptions of the genus *Tomocera* Howard and of its species the *T. californica* Howard type. This Calcidide Hymenopteron, not previously reported in Europe, has been found in Spain, in the Parque de Montjuich, near Barcelona, on *Ficus Carica* and *Myrtus communis*, as a parasite of the *Ceroplastes rusci* and on *C. sinensis*. The Author has obtained 30 specimens of the species in question, all female, from fig and myrtle branches, respectively attacked by *C. rusci* and *C. sinensis*. The first of these coccidae was attacked by many *T. californica* and also *Scutellista cyanea* parasites. On the *C. sinensis*, on the other hand, only one specimen of *Tomocera* was found. It should be noted that the myrtle and fig trees attacked by *Ceroplastes* grew near one another.

The characters of two other Calcidide Hymenoptera living in Spain are also given:

1) *Caratomus megacephalus* (F.) found at San Rafael (Prov. of Segovia), the biology of which is still unknown; 2) *Amblymerus* [illegible] Mercet found on *Olea europaea* at Vaciamadrid (Prov. of Madrid); the biology of the latter is also unknown at present.

G. T.

130. **Leucopis (Neoleucopis) luteicornis n. sp. a Parasitic Dipteron of the Coccid *Phenacoccus iceryoides*, in Coimbatore (India).**

MALLOCH, J. R. A new ephidiphagous fly from Coimbatore. *Memoirs of the Department of Agriculture of India, Entomological Series* Vol., VIII, No. 7, pp. 67-68. Calcutta, 1924.

Leucopis (*Neoleucopis*) *luteicornis* found in Coimbatore as a parasite of the Coccid *Phenacoccus iceryoides* Green ("rain-tree mealy bug"), is described as a species new to science. G. T.

131. **Study of the Methods used for Control of the Olive-fly (*Dacus oleae*) in Portugal.**

Report of Mr. A. F. DE SEABRA, Head of the Section for special studies in the Laboratory of Plant Pathology "Verissimo d'Almeida", at Coimbra, transmitted by Mr. E. LEÃO, Delegate of Portugal at the International Institute of Agriculture.

Introduction. — The Portuguese Mission for the study of biological and chemical methods for the control of the "olive-fly" (*Dacus oleae*), has not at present got beyond a general organisation of the work to be done in the country.

In Portugal the olive tree is not an object of great care: periodical pruning often neglected, rarely tilled, hardly any manure applied. This hardy tree, thoroughly well adapted to our climate, has endured all the inclemencies of its surroundings without ceasing to develop and to fruit.

Care of the olive, and an endeavour to carry out control of its parasites, and to diminish the consequences of disease, were aims which our agriculturists had never set themselves.

A few years ago the olive in certain parts of the country was attacked by very grave epiphytic disease. A disease of the roots, very similar in its results to that of chestnut, walnut and other trees, has recently caused the death of hundreds of fine trees. Unhappily, from other regions, serious infection is reported, caused by the *Bacillus Savastanoi* (Bacterial tumour of the olive) which has naturally caused anxiety to growers.

The studies on the "olive-fly" carried out by the methods which we have selected in the endeavour to obtain abundant material from all parts of the country, showed not only the importance of these epiphytic diseases, but also their wide extent.

If these studies can be continued for 3 or 4 more years, without diminution of the impetus which the Public Authorities have given, it should be possible to draw definite conclusions as to the importance and the efficacy of the methods employed against *D. oleae*, and also to obtain a thorough knowledge of all diseases and enemies of the olive-tree in Portugal.

The results of these studies, of such economic and scientific interest, will be in proportion to the amount of support which they continue to receive from the Public Authorities, and from those principally interested, the growers.

The present organisation for studying the means of control of D. oleae in Portugal. — After the International Conference held in Madrid in 1923

with a view to the conrol of the "olive-fly", at which the author had the honour to represent the Portuguese Government, and was charged by the Director General of Instruction in Agriculture, Prof. AZEVEDO GOMES, and by the Director of laboratory of Vegetable Pathology, Prof. SOUZA DA CAMARA, to draw up a plan of work for studying the methods recommended abroad for the destruction of *Dacus* and for the study of the biology of the insect, of its parasites and natural enemies.

The author has endeavoured first of all, to be as completely informed as possible, on the present state of the question in the different countries where they have already worked for some years on the solution of this problem, especially Italy, Spain, France and Serbia. The importance attributed to the two chief methods of control, the chemical and the biological, make it essential to collect all possible information in the country on this subject; no other means being available, as none of the methods recommended abroad for the control of the "fly" have as yet been seriously tried, a scheme of work has been drawn up, which was presented at the beginning of last year to the Director General of Agricultural Instruction, and published in our report on the Conference at Madrid (1). (Part of the report is given below).

Organization of experiments and special investigation work. — In considering the present state of our knowledge on the biological study of the *D. oleae*, of its parasites and the means advised for the control of this species, which is so destructive to our olive groves, it is evident that a special service must be organised for investigation and experimental study, which will be able to draw definite conclusions as to the efficiency of the methods to be recommended to growers as being the most practical and economical to adopt in defence of their plantations.

The Laboratory of Plant Pathology, and especially the Section for Special Studies at that Institute, should be charged with the direction of these services.

In the different parts of the country, where olive growing is most intensive, or in other parts, where biological observation of the "fly" or its parasites, may have special interest, esperimental stations should be established to test the treatment and for the direct observation of *D. oleae*.

In other parts, where the olive is not of so much importance, observation stations will be installed, exclusively for gathering information.

The Special Studies Section of the Laboratory will become the Central Station and will be linked to all the experimental and information stations.

The different stations should, where necessary, keep up a direct correspondence with the growers in the different areas.

Special Organisation of Services. — The Central Station (Section of Special Laboratory Studies) independently of direct observations and expe-

(1) International Conference held at Madrid for the control of *Dacus oleae*, or the olive fly (mosca da azeitona). Report presented to the General Director of Agricultural Instruction, Dr. Mario De Azevedo Gomes, by A. F. de Seabra, Portuguese Delegate to the Conference (Coimbra, 1924, p. 58, map 1).

iments on treatment, which it should carry out under the same conditions as those applying to the experimental stations, should also direct the organization of all scientific and experimental investigations as regards these studies, furnish all the necessary instructions to these stations and put at their disposal the necessary means for work.

In these experimental stations, as well as at the Central Station, the work carried out in the plantations should be accompanied by meteorological observations, made in the locality.

The Central Station should receive periodical information from the different stations and material for study, specimens of blighted fruit, etc., in order that an exact knowledge of the invasion may be obtained. Specimens of *D. oleae* and its parasites must also be procured from different parts of the country.

The experimental stations, besides carrying out the work confided to them by the Central Office and all the investigations on the biology of *Dacus* and its parasites, asked for by the Office, could also make other experiments and carry out other studies, with special regard to the application of the methods advisable in each district.

To facilitate correspondence and the forwarding of specimens, it will be necessary to obtain free postage, on the grounds of public utility, and as belonging to a national service.

The information stations should take entire charge of the correspondence with the Central Station and when necessary, with the olive-growers of the district or department in which they are established.

The staff of the Central Station will be composed of the Head of the Section for Special Laboratory Studies, a forest expert, an agricultural expert, and a demonstrator.

In the experimental stations a forest expert and an agricultural expert should be added to the staff engaged in field work.

The directors of experimental stations should send a detailed report each year to the Central Office, to be printed and used by the Central Station for drawing up an annual report. According to the decision of the International Conference at Madrid, these reports will be communicated to the International Institute of Agriculture at Rome, during the first half of October each year. The Institute must communicate the results obtained to the countries concerned in the shortest possible time. The Conference of Madrid has expressed a wish that a permanent International Commission of Experts should be formed, with a view to the study of the various matters concerning the " olive fly ". This Commission must meet at least once a year. The first assembly will take place at the International Institute of Agriculture in Rome. At each Assembly it will be decided where the next will be held.

The study of the biology of the *D. oleae* and of its parasites, as well as methods to be tried, as being the most practical and economical way of control ought to be repeated for two or three years in all parts of the country.

Conclusions on the subject of the special service organization. — Having thus explained the importance to the country of the organisation of

special services for the destruction of the "olive fly" by the use of artificial methods, as well as by biological or natural methods, it is suggested that the service be considered of public utility and therefore come under the benefits of the law, by which means it can have practical and immediate realization.

The chief direction of the services ought to be assigned to the Laboratory of Plant Pathology, as it is the official institute of the Ministry of Agriculture and is organised especially for this work.

Considering also, that very particular attention must be given to these studies for which it will be necessary to have a specialized investigation staff, the direction ought to be entrusted to the Section of Special Studies of that Laboratory which is at present established at Coïmbre, one of the most centrally-situated parts of the country and very important from the point of view of olive culture.

Considering the importance of investigations carried out in different climates and altitudes, the experimental stations will be established in the districts of Braganza, Coïmbre, Leiria, Castelo-Branco, Santarem, Lisbon, Béja, and Faro.

The experimental station of the district of Braganza should be established at Mirandola where olive culture presents a special interest.

The experimental station of Castelo-Branco should be established in a district particularly rich in olive groves. This station, as well as that of Mirandola, ought to possess an experimental field for trial treatments, and investigations on the biology of the *D. oleae* and of its parasites.

The experimental station of Leiria should be established under the same conditions. At Santarem, because of the exceptional importance of the olive plantations in this district, in addition to the experimental station, which could be established at the Agricultural School of the district, having also an experimental field, there ought to be other experimental fields in different areas for the study of methods of treatment and of the biology of the "fly" and its parasites.

The station of Béja should be established also in a district rich in olive-trees, such as Moura, for instance.

Owing to the special conditions of the area and particlarly of the climate of the province of Algarve, the experimental station of Faro presents a special interest from the point of view of the biological study of the insect and its parasites. The investigations of this station might preferably be made in the neighbourhood of St. Bras de Alportel, far from the coast, and close to Tavira, near the sea.

Information stations should be established in agricultural districts and sub-districts where they do not now exist. These information stations will be a very great advantage in the study of the distribution of the "fly" and of the parasites that might be discovered in the future in the country.

The technical staff entrusted with the direction of the Central Station and of the experimental stations must deal only with their own special studies.

A special fund must be allowed for the travelling expenses of the

technical staff, for salaries of the staff, for purchasing material for experiments and material for study.

The plan given above has been officially adopted. The stations of Coimbre, Santarem, Borba (instead of Moura as at first suggested) and Silves (instead of Faro) have begun work under the direction of the scientific agricultural experts, LUIZ MAGALHÃES, EDUARDO DE ALMEIDA, CAMARA MANUEL and ALMEIDA DE BIVAR.

Experimental fields, independent of these stations, have also been established in the olive groves of the Higher Institute of Agriculture and at the Central Agricultural Station in Lisbon.

Preliminary work. — Although very widespread in all parts of the country where the olive tree is cultivated, the species *D. oleae*, is still confused by growers, because of the nature of the harm done, with other parasites of the olives, particularly with *Prays oleaellus* with regard to insects, and with *Gloeosporium olivarum* among cryptogams.

On the adoption of the scheme of investigation, a circular was sent to the most important growers of the country, containing the necessary instructions for obtaining the greatest possible number of samples of parasitized olives, from all parts of the country, as well as detailed information on the importance of the invasion.

The samples of parasitized olives were specially intended for studying the chorographic spread of the fly and for the verification of the existence of its parasites.

Nearly six hundred circulars were sent by the Special Laboratory Study Section. At the same time the General Director of Agriculture instructed his agricultural statistics assistants to correspond with the Laboratory, and tried to obtain also as great a number of parasitized olives as possible.

Meanwhile the staffs of the stations organised for studying experimental methods for the control of *Dacus*, tried to obtain and forward to the Central Station a large number of specimens from their districts.

In a few months it has been possible to organise a system of official and private correspondence, which has kept us well informed of the advance of the invasion.

The meteorological conditions severely handicapped chemical experiments. However, several hundreds of trees were treated in the experimental fields of the different organised stations.

The Lotrionte process seems without doubt the only one which can be adopted profitably in the country, because of the irregularity of the seasons.

The experiments to control the fly by artificial means, being thus handicapped, especial attention was given to to the study of biological methods and in trying to obtain a large number of parasites of the " fly ", and limiting ourselves for the moment to ascertain the species, and to know their chorographical spread and their numerical importance.

Very concise instructions have been distributed to all the growers and to the staff of the General Direction of Agriculture who were asked to collaborate in this study, also a number of little wooden boxes were sent,

of the type used by the laboratory at Washington for the study of the "brown tail moth" (*Euproctis chrysorrhoea*).

In a few weeks several samples of the parasitized olives had been [illegible]lected in the Laboratory, by which means the existence of "Dacus" and other olive parasites, especially *Pr. oleellus*, have been verified.

The elaboration of an annual report on these studies is very difficult at this time of the year, which is just the time of the greatest activity of the investigation and experimental work.

The period when the "fly" and the affected plant are at rest seems to be the only time available for this work. The months of February, March or even April, would be the most favourable for us at least, to collect the results of the work and to elaborate a general report on the results.

First trials of treatment. — The first trials of treatment were carried out in the experimental fields of Coïmbre, Santarem and Borba.

The insecticides used in these experiments were prepared at the Central Station and forwarded in concentrated solution to the stations.

The following formulae were tried:

Molasses	65 parts
Honey	31 "
Glycerine	2 "
Arsenate of soda	2 "
Water	10 "

Liquid glucose	7 kg.
Copper sulphate	700 gm.
Citric acid	40 "
Water	10

Molasses	7 kg.
Copper sulphate	700 gm.
Citric acid	40 "
Water	10 l.

Molasses	7 kg.
Copper sulphate	700 gm.
Citric acid	40 "
Arsenate of soda	400 "
Water	[illegible] l.

(dilute with three parts water).

Molasses	10 kg.
Arsenate of soda	[illegible] gm.
Water	[illegible] l.

Molasses	[illegible] kg.
Arsenate of soda	[illegible] gm.
Water	[illegible] l.

Molasses	15 kg.
Arsenate of soda	300 gm.
Water	100 l.

Molasses	19 kg.
Arsenate of soda	200 gm.
Water	100 l.

Molasses	5 kg.
Arsenate of soda	200 gm.
Boracic acid	200 "
Borate of soda	200 "
Water to	10 l.

Molasses	5 kg.
Arsenate of soda	200 gm.
Boracic acid	200 "
Borate of soda	200 "
Water to	10 l.

Liquid glucose	5 kg.
Arsenate of soda	200 gm.
Boracic acid	200 "
Borate of soda	200 "
Water to	10 l.

The employment of these insecticides was rendered almost useless, by the continual and abundant rains of the season.

At Coïmbre, according to the report the Director of the station at the National Agricultural School, nearly 1500 trees were treated.

For direct spraying, rods of three or four metres in length, adapted for ordinary spraying and used in the northern part of the country for treating vines hung from the trees, were successfully employed.

The difficulty of promptly obtaining shelter for trials of the Lotrionte method, hindered its employment during 1924.

At Borba, the same formulae were tried, but the rains interfered with keeping up these treatments. To apply the Lotrionte method, shelters of sheet iron, tiles and cork were tried, the last being the most economical and suitable for the district.

At Santarem, several trees were treated by employing exclusively the direct spraying method.

At the Silves station, owing to special conditions, chemical treatments were not tried, but sufficient material has been collected to begin new treatments when convenient, and three thousand tiled shelters have been built already for the application of the Lotrionte method.

First studies on the biology of D. oleae and its parasites. — The biological study of *Dacus* and its parasites was started rather too late to be able to estimate the number of "fly" generations in the different parts of the country, and to follow the biology of its parasites.

It is thought that only the eggs of the last but one generation were obtained, the grubs of which hatched towards the end of October.

The number of parasites obtained up till now is still limited. Nearly all these parasites came from olives from the Alemtejo province.

All observations on this subject of view are preliminary, as material arrives every day from different parts of the country.

132. **Control of the Olive Fly (*Dacus oleae*) in Portugal.**

DE SEABRA, A. F. Instruçoes sôbre os processos acosellhados para combater o Dacus oleae ou Mosca da Azeitona. (Ministério de Agricultura. Direcção Geral do Ensino e Fomento. Laboratorio de Patologia Vegetal Verissimo d'Almeida), pp. 25, Fig. 8. Coimbra, 1924.

In Portugal, *Dacus oleae*, commonly known as "Moscada azeitona" and wrongly called "Gafa", a word that should only apply to that disease of the olive resulting from the *Gloeosporium olivarum* Almeida which has for a long time caused great damage — in many cases exceeding 10-15 000 contos a year (an equivalent of 56-84 million francs, at par).

The first generation of the fly, produced by the winter flies, appears at the end of March. The individual flies of this reproduction cause a disease in the olive which increases in intensity as the fruit develops, because of the advent of successive swarms of flies that continue to reproduce until the end of October. During the most prolific period of the propagation of this species, i. e., June to September, the metamorphosis of the insect required 23-25 days (1-2 stage of egg, 12-13 that of larva and 10 as chrysalis); 8-10 days after the appearance of the adult fly the females deposit their first eggs.

Nothing has been attempted in Portugal up to the present time to free olive trees from the pest. The object of this publication is to diffuse knowledge of methods of combatting the pest by chemical and other means e. g., spraying, immersion, combined spraying and immersion, etc., and by natural or biological processes (i. e., making use of the natural enemies of the *D. oleae*) such methods being already well known and largely used in other countries where the olive is cultivated; they could be improved and applied to the olive in Portugal, and adapted to the conditions of local cultivation. The publication also supplies information regarding the organisation of the artificial means of fighting the disease, the spraying apparatus, and the preparation of insecticides.

Besides directly fighting the insect, it is also imperative to prevent its propagation by eliminating as far as possible, conditions that further its development. There should be mentioned among preventive methods: 1) Scrupulous cleanliness of oil-presses, the lining of their windows with narrow metal nets, in order to prevent the fly larvae from being carried over on the olives, becoming detached from the fruit, and completing development on the spot, and so increasing the number of the adult insects. 2) Abolition of the method of beating olive branches; this results in the scattering of a quantity of larva-laden olives which, especially when the groves are in close proximity to thick hedges, results in unimpeded development of the larva and propagation of the fly.

G. T.

133. **The Control of the "Olive Fly" (*Dacus oleae*) in Cenia (Spain).**

La campaña contra la mosca olearia en Cenia. *Boletín mensual de olivicultura y elaboración moderna del aceite de oliva*, No. 71, p. 476. Tortosa, 1924.

In 1924 the "Estación Olivarer" at Tortosa, with the aid of the "Consejo Provincial de Fomento" at Tarragona, and with the consent of some proprietors at Cenia, carried on a campaign against the "olive fly" (*Dacus oleae*), applying the spraying method on about 12,000 olive trees divided into 3 lots.

In the first lot, situated at a height of 350 metres, the treatment was begun on 2 July. For the first four sprayings the ordinary insecticide mixture with a basis of sodium arsenate and molasses was used; the fifth spraying was with Bordeaux mixture and the sixth with sodium arsenate. All the olive-trees, including those of the "Empeltre" variety, which is first attacked by the "fly", bore entirely healthy fruit. The few olives which had fallen to the ground had been detached from the tree through the intense drought. The arsenic at the strength of 2 ½ parts per 1000 caused some scorching; the solution at 1 ½ per 1000 did not. The olives on the property bordering the lot under treatment were damaged by the "fly" to the extent of about 90 %; those of the "Empeltre" variety were all attacked; about 50 % of the "Marons" variety, very hardy and resistent against the "fly", were attacked.

In the second lot 6 sprayings were given rather late, but still in time owing to the slow development of the olives; the ordinary insecticide mixture and Bordeaux mixture were used. About 3 % of the olives were punctured by the "fly" of the first generation, but the punctures completely cicatrised. On the holdings in the immediate vicinity, not subjected to the treatment, almost the entire crop was lost; it was difficult to find olives which were not worm-eaten.

In the third lot, which contained as many as 6000 olive-trees, sprayings with the ordinary insecticide mixture and Bordeaux mixture were used at the right time; it is calculated that not more than 3 per 1000 of the olives were punctured by the "fly". G. T.

134. ***Brassolis istmia*, a. Macrolepidopteron. Injurious to the Coconut Palm and other Plants, in the Republic of Costa Rica.**

La plaga de gusanos en la comarca de Limón. *Boletín de Fomento*, Year V, No. 1, p. 68, 2 tab. San José, Costa Rica, 1924.

At the beginning of July, 1924, there appeared in the neighbourhood of Limón a caterpillar, in all probability imported with vegetables and fruit from Andrés Island or from Jamaica, which was recognised as belonging to *Brassolis istmia*.

This insect multiplied to an extraordinary extent and its larva fed with great voracity during the night, especially on the leaves of various plants, whereas during the day it remained hidden. It prefers the sugar-cane, cocoa tree, coconut-palm, and in the absence of these host plants, the banana.

In the absence of adequate means of control it has not been possible to destroy the pest with sufficient rapidity and it has thus destroyed near Limón and Cieneguita, extensive coconut-palm plantations, by devouring the apical bud and the heart the caterpillar has caused the death of the plant.

The Government has organised an energetic campaign and it is hoped that the measures adopted will prevent the propagation of the insect.

G. T.

135. Insects Injurious to the Vine.

VIVARELLI, L. *Entomologia Agraria*, Vol. I. Insetti nocivi alla vite, Second edition (Biblioteca Agraria Ottavi, Vol. CX). XV, 350 pp., fig. 93. Casale Monferrato, Ottavi Bros., 1924.

This is the second edition, — slightly altered and greatly improved by numerous additions, — of the handbook printed for the first time in 1911. It provided the practical agriculturist with a simple and concise guide book enabling him to distinguish species of insects that do most damage to the vine. After dealing with the general characteristics of insects and their classification, descriptions are given of the principal types of Rhynchota, Thysanoptera, Lepidoptera, Coleoptera, Hymenoptera, Orthoptera and Diptera that are injurious to plants; in each case, the best methods of combatting the evil are given, i. e., those that have proved to be most efficacious, easiest of application, and the most economic in practice.

The Appendix gives descriptions of a few acaridae, and of a nematode (*Heterodera radicicola*) and describes methods of control.

G. T.

136. *Franklinothrips myrmicaeformis* n. sp., a Thysanopteron found on the Vine, near Bengasi (Cyrenaica).

ZANON, V. Nuove specie di "Franklinothrips" (Thysanoptera) raccolta a Bengasi. Extract from the *Atti della Pontificia Accademia delle Scienze Nuovi Lincei*, Year LXXVII, 9 pp., figs. 3. Rome, 1924.

A description of *Franklinothrips myrmicaeformis* n. sp. (Thysanoptera) from the only example found, in August, 1920, on a vine leaf, at [illegible] near Bengasi (Cyrenaica). The author does not consider this insect injurious to the host plant, but perhaps attracted to it in search of prey by the presence of *Retithrips aegyptiacus* Marchal which had for some years infested the vines in the garden where the new representative of the *Franklinothrips* gen. was found and of which only two species are at present known (*Fr. vespiformis* Crawf. and *Fr. tenuicornis* Hood), discovered in some localities in America.

The description of *Fr. myrmicaeformis* is followed by a detailed comparison between the morphological characters of this and *Fr. vespiformis* to which the former is similar.

G. T.

137. **The Coccid *Chionaspis citri* and its Diffusion in Uruguay.**

TRUJILLO, PELUFFO, A. *Chionaspis citri* Const. Cochinilla de los citros. *República Oriental del Uruguay, Ministerio de Industrias, Defensa Agricola, Boletin mensual,* Year V, Vol. 7-8, pp. 109-112, figs. 3. Monte Video, 1924.

Chionaspis citri Const. (*Howardia citri* Berl. and Leon.), which attacks all the aereal parts of the bitter fruits (oranges, mandarins and lemons) is one of the now numerous coccids unknowingly introduced into Uruguay with vegetable products from abroad. Its presence was only reported some years ago in the Republic, where its slight attack was at first limited to the Department of Monte Video. To-day, however, not only are bitter fruits noticed to be much infested on properties in the neighbourhood of Monte Video, but also, in consequence of the rapid diffusion of the coccid across the Uruguayan territory, the parasite is beginning to appear in considerable numbers in the plantations of the principal bitter-fruit zones of the Departments of Salto, Rivera and Cerro Largo.

A description of the species is given.

The first generation of the insect begins to develop, in Uruguay, about the end of September and the beginning of October.

Frequent winter sprayings (3 or 4, at intervals of 15 or 20 days) with "Rubina", petroleum emulsion and sulphate of lime solution, have been found the most effective against this insect.

G. T.

138. **Insects Injurious to Forest Plants in Italy.**

CECCONI, G. *Manuale di Entomologia forestale.* Volume XIX+630 pp., figs. 786. Padua, 1924.

The author, who was formerly a lecturer on Zoology at the R. Institute of Forestry at Vallombrosa and the Higher R. Institute of National Forestry at Florence, and is now Director of the R. District Phytopathological Observatory for the Marches, with its head quarters at Fano (Prov. of Pesaro), has completed his Manual of Forest Entomology, which is the first of its kind in Italy; it was first published in brochure form in 1914.

Besides the introduction and some pages in which the classification followed by the author is set forth, the volume contains seven chapters on, respectively, Orthoptera, Dermaptera, Lepidoptera, Hemiptera, Coleoptera, Diptera and Hymenoptera.

The diffusion of the separate species reported as injurious to Italian forest plants is indicated; then follow the morphological and biological description of the insects, their habits, ther relations with the plants which harbour them and the natural and artificial means of combatting them.

The volume contains three indexes: one for the insects in question, one for the plants and one for the artificial remedies mentioned or described. 786 illustrations are inserted among the 700 pages of the text.

G. T.

139. The "Gipsy Moth" *(Lymantria dispar)* injurious to the Chestnut in Switzerland.

BADOUX, H. Apparition du bombyce disparate dans un taillis de châtaignier au Tessin. *Journal Forestier Suisse*, Year 75, No. 11, pp. [illegible], 1 Plate. Bern, 1924.

Liparis dispar (Lymantria dispar) has appeared here and there in the forests of Switzerland, but without causing great damage.

After the attacks in 1888 and 1907, quickly stopped in the first case by the effective intervention of the numerous natural enemies of the insect and in the second by a sudden change of temperature, in consequence of which attacks there was only a loss of growth in beeches and larches, which were deprived of their leaves, the caterpillar of the "gipsy moth" has again appeared in Switzerland, during the summer of 1924, in a copse of chestnuts in the canton of Tessin.

All the trees over an area of about five hectares have been completely deprived of their leaves.

Owing to the natural enemies of this pest and to the hardiness of the chestnut, the damage has not assumed serious proportions.

G. T.

CURRENT NOTICES

Legislative and Administrative Measures.

140 **Argentina : Measures of Control against the Pink Bollworm and other Cotton Parasites.** — The " División de Defensa Agrícola, Policía de los vegetales " in Argentina has issued regulations by a Decree of 2 July 1924, relating to the pink bollworm, locally known as " Lagarta rosada " (*Gelechia gossypiella*), to supplement the previous decree of 10 June 1924, published for the same purpose of agricultural protection. The national territories of the Chaco and Formosa and the provinces of Santiago del Estero and Corrientes are scheduled as infested by the " Lagarta rosada " or pink bollworm. No quantity of cotton bolls or seed which may be found in these areas may be transported outside the area, unless accompanied by a certificate of health, countersigned by the competent authority, on which it is stated that the seed has been subjected to the processes of disinfection indicated in the regulations. Establishments for cleansing and handling cotton bolls or seed must be registered in a special Register of the Department of Agriculture and Agricultural Protection, and equipped with the necessary disinfecting plant, and may not begin work without authorization from the Department which proceeds to hold the required inspection, and on request will supply official plans for the installation of disinfecting chambers. The disinfectant recommended by the Government regulations is carbon bisulphide in doses of 400 gm. per cubic metre and left to work for 24 hours at a minimum temperature of 16°C. and if possible at a temperature of from 21° to 25°C. The establishments are however authorised to employ modern systems of disinfection other than the official. Government disinfecting stations will be established by the Ministry of Agriculture, when and where considered desirable. Quantities of seed, whether intended for sowing or merely in transit must, be accompanied by a label showing that the necessary disinfection has been carried out. Breach of the regulations of the Decree is punishable with immediate destruction of the seeds or of the whole crop and with withdrawal of the official license granted to the defaulting establishment, without prejudice to the heavier penalties imposed by the Codes.

As regards the methods for prevention and destruction of other cotton parasites, specified in the Decree of 10 June 1924, the instructions, published in the preceding circular No. 180, dated 27 October 1923, by the Ministry of

Agriculture, are made obligatory. (*Ministerio de Agricultura de la Nación, Sección de Propaganda e Informes*, Circular No. [illegible]. Buenos Aires, [illegible]).

141. **Brazil: Reduction of the Price of Coffee intended for Home Consumption.** — The President of the Republic of Brazil has lately given assent to a law voted by the Congress, giving power to the President himself: to prohibit the export of coffee, up to 5 % of the quantities intended for export preference being given to coffees of grade 7 or inferior grades; to regulate the distribution in the States of Brazil of the quantities not exported, as also the home market prices in accordance with the requirements of consumption in Brazil, as reported in the first six months of the year 1924; and on the question of distribution and of payment to consult with the coffee producing States. (*Brazil Ferro-Carril*, Year XV, Vol. XXVII, No. 375).

142. **Exemptions from Customs Duties for certain Foodstuffs of Prime Necessity.** — A Presidential Decree has been published, exempting from customs duties rice, maize, beans, potatoes, condensed milk, butter, lard and dried meat or "xarque", with the object of bringing down the price on the Brazilian markets of these articles for home consumption.

A Bill was also brought forward in the Chamber for exemption in the Customs from the tax of 60 % in gold for the following goods: lard, dried meat, condensed and other forms of preserved milk, dairy butter, fresh fish, fish dried, salt, or otherwise preserved, certain kinds of cheese, fresh or preserved fruit, rice, wheat and wheat flour, maize, potatoes, onions, olive oil, kerosene. (*Brazil Ferro-Carril*, Year XV, Vol. XVII, No. 369).

143. **United States: Federal Forest Legislation.** — Measures have been enacted for the protection of forests and the re-afforestation of denuded or non-forested lands, and to ensure the continuous production of timber. The Secretary of Agriculture shall act, as regards the application of the regulations issued, in co-operation with the appropriate officials of each State or any other public or private body having competence in the matter. Special attention will be given to the protection of forest land from fire, and while in the course of this co-operation with the several States due consideration shall be given to the protection of watersheds of navigable streams, such co-operation may, in the discretion of the Secretary of Agriculture, be extended to any timbered land. Fiscal measures will be prepared designed to encourage the conservation and growing of timber, and methods of insuring standing timber against losses will be investigated and promoted. A sum of 1,500,000 dollars will be appropriated annually to enable the Secretary of Agriculture to carry out the provisions of this legislation.

In co-operation with the various States steps will be taken to procure, produce and distribute forest-tree seeds and plants, for the purpose of establishing wind breaks and shelter belts upon denuded or non-forested lands so as to give protection to forest plantations. A further sum of [illegible] dollars will be placed at the disposal of the Secretary of Agriculture for this purpose, and a similar sum will be appropriated for expenditure in assisting owners of farms to improve their land in this way.

For the purpose of regulating watercourses and encouraging the production of timber, the National Forest Reservation Commission shall have power, on the report of the Secretary of Agriculture, who will in this case be assisted

by the Director of the Geological Survey, to purchase, on agreed conditions, either forested or denuded lands or other lands.

The Secretary of Agriculture is authorized to accept, on behalf of the United States, from owners of lands chiefly valuable for the growing of timber crops, the title to any such land either as a gift or bequest. Any lands to which title is accepted shall become national forest lands subject to the provisions of the Act of 1 March 1911 and amendments thereto. The donor may in all cases reserve rights in respect of the present stand of merchantable timber or of mineral or other rights on the land so accepted, and for a period not exceeding twenty years.

The President of the United States has power to establish as national forests, or parts of national forests, any lands within the boundaries of Government reservations, other than national parks, reservations for mineral deposits or water-power purposes, national monuments, and Indian reservations. (Public No. 270, 68th Congress, H. R. 4830 and *International Institute of Agriculture*, Legislative Texts, No. 15, 1924).

144. **United States: Inspection Division Established.** — On August 1st the Secretary of the Interior issued the following order: Effective August 1, 1924: all investigating forces of the several bureaus of the Department shall be consolidated into a division under the office of the Secretary, to be known as the Inspection Division, Department of the Interior. (*New Reclamation Era*, Vol. 15, No. 9, Bureau of Reclamation, Washington, D. C., 1924).

145. **Madagascar: Regulation of Sericulture.** — A Decree of 2 August 1924 has made regulations for the sale of silkworms, instruction in and study of sericulture, and prizes for silkworm breeders. The sale of silkworms in any part of Madagascar is prohibited except under special license, such license being granted only to persons who are known to be experts in th production of seeds free from disease. If necessary the silkworm breeder is required to be able to make examinations under the microscope. The breeding bags cannot be offered for sale except with a seal attached bearing the name of the seller and the date of marketing, and they are at any time liable to inspection.

Instruction in sericulture is given at the Nanisana Agricultural Station which carries out the investigations necessary for the improvement of sericulture and arranges for the sale of selected seeds, as contained in the breeding bags, at the price fixed by decision of the Governor General. Seeds are also sold under the same conditions by the Antsirabe and Ambatofinandraahna Stations.

A premium is allowed to the breeders of 20 centimes per kg. of cocoons sold to the spinning establishments, provided such cocoons have been obtained from seeds coming from the sericultural stations or from authorized sowings. An annual premium of 400 francs is granted to the spinner who produces thread for export, for each tray reeling from more than three filaments and a premium of the same amount is granted to the accessory trays, in the proportion of one accessory for every three trays reeling from more than three filaments and less than six and of one accessory for every two trays using more than six filaments. The annual production of thread must not be less than 60 kg. of raw silk per tray. The Decree is applicable on the provinces of Tananariva, Moramanga, Itasy, Vakinenkaratra, Ambositza and Fianarantssa. (*Journal Officiel de la Rép. Franç.*, 4-5 August 1924).

146. **Nyasaland: Measures for the control of Diseases of Plants and Animals.** — Order No. 1 containing regulations for the prevention of the introduction and diffusion of plant diseases and pests. — Order No. 5 relating to the diseases of stock. — Order No. 7 for the protection of wild birds. (*Supplement to the Nyasaland Government Gazette*, Vol. XXXI, No. 1, 1 February 1924).

147. **Latvia: Production of Seed for Sowing.** — The "Instructions relating to the establishment of plots for production of seed for sowing" are as follows:

I. *Establishment of cultivation plots for the production of seeds for sowing.*

(1) Plots for the production of seeds for sowing are established with the consent of the Department of Rural Economy and on the basis of an agreement made between the body establishing the plot and the owner of the land, said agreement to be in writing and a copy sent to the Department.

Note. For the purposes of seed production plots farms must be selected when the land is well tilled and highly productive, i. e. which yields crops of not less than 18 quintals of rye, 16 quintals of oats or of barley per hectare.

(2) In the agreement the owner of the seed production plot undertakes:

(*a*) to grow on his own farm only the special kind of rye, barley, etc. specified in the agreement, so as to avoid any possibility of mixture;

(*b*) to restore to the establisher of the proposed plot, that is to say, the supplier of the seeds required, the quantity of seed received with a 25 % addition, after which the selection of the seeds may be made in accordance with the provisions laid down.

Note. For potatoes, a 50 % addition is to be made to the quantity to be restored.

(*c*) to make the selection and separation of the seeds in autumn, before any sales take place and in accordance with the regulations, and then to summon the representative officer of the seed production plot organisation, who after having satisfied himself of the state of the seeds thus produced, makes an official report stating the quantity of seed and its grade in purity; a copy of this report must be at once sent to the Department of Rural Economy.

Note. If the organizer of the seed production plot finds that the seeds have not been properly selected, he may require the selection to be repeated till the prescribed grade of purity is attained.

(*d*) to offer for sale, for three years in succession, a quantity of seed, including that returned to the establisher of the plot, 6 times in excess of that received for the purpose of starting the plot.

Note. This amount relates only to cereals.

(*e*) to offer for sale only seeds of which the purity and capacity for germination are guaranteed according to the regulations.

Note. Disputes are decided after inspection carried out by the Laboratory of Latvia and by a second Seed Inspecting Officer appointed by the Department of Rural Economy.

(*f*) to plough and attend to the sown fields in accordance with the clauses of the engagement entered into.

(3) The organiser of the seed production plots undertakes:

(*a*) to supply to the owner of the plots seeds in sufficient quantity for the sowing of the special area.

Note 1. For seeds of forage crops the area must not be less than one-third of a hectare.

Note 2. No exceptions can be made in this respect, other than with the consent of the Department of Rural Economy.

(*b*) to pay premiums to the owner of the proposed plot. For every quintal of cereal seed, sold before 1 March and accepted by the Commission as selected and separated in accordance with the prescribed rules, the premiums are as follows:

First Crop:

7 lats and 50 per cent. for selected seeds belonging to choice strains;

(*Officials payments are calculated in the projected gold currency, the gold franc (lat) = 50 Latvian roubles*).

5 lats for ordinary local strains.

Second and Third Crops:

5 lats for selected grain of the choice strains:

3 lats and 50 per cent. for the ordinary local strains.

For linseed:

First year, for every quintal of linseed well selected, approved by the Commission and sold. 15 lats

for every quintal of ordinary local seed . . . . . . 10 lats

Second year and third year:

for every quintal of linseed selected and sold . . . 10 lats

for every quintal of local seed . . . . 7 lats

For potatoes:

First Crop:

for every quintal of selected and choice potatoes . 1.20 lats

for local of ordinary quality potatoes . . . . 1.00 lats

Second and Third crop:

selectedand choice potatoes. . . . . 1.00 lat

local potatoes of ordinary quality. . . . . 0.50 lat

II. *Provision of the Seeds.*

(4) For the establishment of seed production plots, seeds cultivated in Latvia must be employed and selected seeds from other countries, so far as the natural conditions of Latvia allow.

(5) The seeds so grown in Latvia may include either selected seeds or local strains if not mixed. Seeds from abroad must not show any signs of degeneration.

(6) The Department of Rural Economy is to summon a Commission of Experts to deal with the question of seed production plots and to decide on the kind of seeds which may be profitably cultivated in the different regions in which production plots are instituted.

(7) Farmers, etc., possessing good quality seeds of cereals, flax, potatoes,

and other crops, may offer them to the agricultural organizations, supplying the following particulars:

(a) District, commune, name of farm and address of the cultivator;

(b) seed licence;

(c) specification of the kinds of seeds intended for sale;

(d) length of time during which certain kinds have been cultivated;

(e) average yield per hectare;

(f) sifters on the farm; if there are none, the name of the nearest place where there are sifters, with the distance from the farm in question;

(g) roads leading to the farm (and the distance from the railway), etc. in case of a visit of inspection;

(8) The agricultural organizations shall forwards copies of this information to the Department of Rural Economy.

(9) In order to ascertain the quality of the seeds offered, a committee of experts belonging to the organization which is to carry on the seed production plots is to carry out a local inspection. The day of this visit is to be fixed in advance by agreement with the Department of Rural Economy, in order that a representative of the Department may attend, if necessary.

(10) The Committee of Inspection makes an agreement with the owner of the seeds as to their price, in the event of the organization wishing to purchase them with the consent of the Department.

(11) The seeds must be well selected, dried and separated: the extraneous matter present in the case of cereals must not exceed 2 %, in that of clover seed 5 %, and of linseed 3 %. The proportion of seeds capable of germination must not be less than 95 % for cereals, 90 % for linseed and hybrid clover, and 87 % for meadow clover.

The proportion of hard clover seed considered likely to germinate is one third. Potatoes must weigh from 50 to 100 grammes. In potatoes for industrial uses, the proportion of starch must not be less than 16 %, in table potatoes, not less than 12 %.

(12) If the selection of the seeds for the market cannot be made by the cultivator himself, because he has no sifters, he informs the purchasing body of the fact and in that case the purchasers themselves undertake the sifting.

(13) The purchaser and the seller come to an agreement as to the cost of transport of the seeds, the charge for the sacks, etc.

(14) As regards the purchase of foreign selected seeds, the parties responsible for the plots make arrangements with the Department of Rural Economy.

III. *Supervision and Inspection of the Cultivation Plots.*

(15) The general supervision and inspection of the seed cultivation plots is in the hands of the Department of Rural Economy. This Department also controls the activity of the organizations and the establishments which undertake the management of these plots and receive a Government grant for the purpose.

(16) If there is any default on the part of the party organizing the plots, whether an institution or a private person, the Department of Rural Economy has power to suspend the payment of the grant and to bring the defaulting party before the magistrate.

(17) The seed growers stand to lose either the whole or a part of their [illegible]

to the grant referred to in § 3, if it becomes necessary on financial grounds to cancel the appropriations proposed and required for the purpose.

(18) Any seed grower who has knowingly effected an admixture or any other fraudulent manipulation of the various kinds of seeds will on the decision of the Inspection Committee be deprived of his license, and compelled, without right of appeal, to refund the grants he has received, the amount of which will be added to that of the State taxes he has to pay.

(19) The Department of Rural Economy fixes the number of the seed cultivation plots to be established on the basis of the sum appropriated for the purpose.

(20) The seed growers are expected to maintain the fertility of the soil and with this object they shall apply for a sufficient quantity of fertilisers, natural or artificial, taking into account the condition of the soil. They are to cultivate the soil in accordance with good farming methods, to select the seeds with every care, and to keep the ground weeded and free from insect pests.

Note. Under 20, more detailed instructions will be issued by the Department of Rural Economy where necessary.

(21) (*a*) The Inspection Committee, which includes 2 or 3 experts who are not interested parties, will visit the farm and satisfy itself as to the state of the sown lands;

(*b*) The organizations responsible for the cultivation of seeds nominate the members of the Committee who are afterwards appointed by the Department of Rural Economy;

(*c*) If the Department itself is responsible for the seed cultivation, the members of the Committee are chosen and appointed directly by it.

(*d*) The report of the results of the Inspection must be sent to the Seed Testing Station, and until the institution of this Station, to the Department of Rural Economy.

(22) (*a*) The Higher Inspection Committee of the sown lands, which consists of two expert officers of the Department, the director of the Government Selection Station, a representative of the Faculty of Agriculture in the University of Latvia, and of a representative of the Association of Agricultural Officers — the chairman being either the Director of the Department or a person nominated by him — decides on controversial questions and disputes.

Note 1. As soon as the Seed Testing Station is established it will be represented on the Higher Committee.

Note 2. In special cases the Higher Committee has the right to add to its numbers by co-option of competent persons and to summon experts.

(*b*) Payment of the prices reckoned as follows per kilogramme of seeds offered for sale is made for the first three crops of forage seeds:

30	centimes	for	meadow clover
40	"	"	cats' tail grass.
40	"	"	oat grass (*Avena pratensis*).
80	"	"	white clover.
40	"	"	alsike clover (*Trifolium hybridum*).
80	"	"	cock's-foot grass.

(c) The owner and the purchaser are to agree as to the price of the seed

(d) The counterfoils of the receipts issued to the purchasers of seeds are the owner's vouchers for the quantity of seed sold. The body organizing the cultivation plots draws up a report showing the names and addresses of the purchasers, the quality and price of the seeds sold. The original of this report countersigned also by the cultivating owner must be sent to the Department of Rural Economy, where it serves as the basis for the payments made under the head of premiums.

Note. If the owner of the first and second crop has sold a quantity less than that specified in § 2, he forfeits the right to receive premiums for the third crop.

(e) If the owner of the seed production plot obtains especially favourable results, the representative of the organization in the presence of two witnesses, including an agricultural expert, makes an inspection of the sown lands and draws up a report which he presents to the Department of Rural Economy recommending the owner for honourable mention. The Department of Rural Economy receives notice of this inspection two weeks before it takes place, so that, if necessary, a representative of the Department may attend.

(f) The institution responsible for the seed production plots engages to do its utmost to induce neighbouring farmers to use only the kinds of seed grown on its model farms, and also organises a succession of seed crops by means of seeds produced on plots already established, and endeavours to obtain general acceptance for the idea of forming agricultural associations for the special purpose of growing these seeds and no others.

(23) It is the duty of the Inspection Committee to satisfy itself by means of a visit to the place of cultivation:

(a) whether the seeds employed are completely free from impurities and are not mixed with other kinds;

(b) that there are no weed seeds among the seeds;

(c) whether the seeds have germinated satisfactorily and punctually;

(d) that the seeds are not attacked by disease, such as *Puccinia*, *Ustilago*, etc.;

(e) that rye and the other cereals are sufficiently protected when flowering against fertilization by other species.

If the presence of any factors which tend to prevent the normal development of the seeds is proved, official recognition will not be given to the seed crop. Similarly seeds that have germinated only moderately well are not recognised.

Note 1. Grasses do not constitute a reason for refusal of official recognition, except in the case in which the grasses grow so freely as to overwhelm the cultivated plants and interfere with their proper growth.

Note 2. Where necessary, the Department will further define clause (e) in detail.

(24) If the quantity of seeds not approved exceeds half the seeds grown, the remainder of the seeds of that year will not receive approval and the owner will not have the benefit of a premium. It will be the duty of the owner to inform purchasers that the Committee has refused to approve his seeds.

Note. If for two successive years the seeds of an owner are not approved, his license will be taken away and he will have no claim to the grants.

(25) The names of the owners whose seeds have been approved as satisfactory are published in the daily papers and in the Bulletin of the Department of Rural Economy.

(26) The Department of Rural Economy reserves the right to interpret the above provisions.

148. **Latvia : Control of the Manufacture and Export of Butter.** — The Latvian Government has passed a law placing butter intended for export under special restrictions. The quantity of water contained in the butter must not exceed 16 %. The kind of butter and the content in water will be fixed by laboratories to be established for the purpose placed under the Department of Rural Economy of the Ministry of Agriculture. Pending the establishment of these Laboratories, the Laboratory of the University of Latvia undertakes the analysis of the product. On the basis of the results of analysis and also on the basis of the opinion of a committee of experts, the butter is divided into three classes. In the first class is placed butter which has obtained from 11.1 to 15 points, and is natural butter and containing not more than 16 % of water ; in the second butter of from 7.1 to 11 points, containing also 16 % of water ; in the third the product which has been awarded less than 7 points, is not natural and contains more than 16 % of water. Export of butter of this class is forbidden.

Butter which has passed inspection tests and is intended for export must be specially indicated with an inspection mark and the quantity to be exported must not be less than 500 kg. The butter factories and private dairies which desire to become exporters of butter must apply for registration with the Department of Rural Economy of the Ministry of Agriculture this Department having the sole right to inspect registered dairies. (*International Institute of Agriculture.* Legislative Texts No. 25, 1924).

149. **Rumania : Measures for the Encouragement of Sericulture.** — Under the title of " Law for the Protection of Sericulture " the *Monitorul Oficial* of 20 April 1924, published a series of provisions relating to the supervision of the production and sale of silkworm seed, the planting of mulberry trees and the general encouragement of silkworm breeding.

The production of silkworm seed is to be strictly confined to persons, establishments and institutions holding official licenses from the Ministry of Agriculture. The only process permitted is the " Pasteur Cell " or breeding bag process, and all breeding is under Government inspection. The importation of seed is reserved to the Ministry, except in the case of licensed silkworm breeders, who may import the quantity of seed required for their own breeding establishments, but even in these circumstances it is always necessary to hold a license from the Ministry. In order to restrict absolutely any possibility that silkworms will be reared from seed of ordinary and not first grade strains, the right of sale or of free distribution is entirely confined to the Ministry of Agriculture, and to the licensed silkworm breeders. Every breeder is expected to sell his surplus cocoons in such proportion as to make up the quantity required by the different establishments.

In order to encourage the growing of mulberry trees and to add to their

number, the Ministry of Agriculture is forming nurseries of mulberry [illegible] ing them to State establishments, State farms and nurseries, and with [illegible] stance of the Ministry of the Interior is setting up communal nurseries [illegible] plants so produced are distributed free to silkworm breeders and [illegible] for planting the roads, the streets, communal pastures and public [illegible] regions favourable to silkworm rearing. Such plantations of [illegible] are declared to be State property and are placed under the supervision [illegible] care of the communes, which are also obliged to inform the District [illegible] Agriculture of the number of mulberry trees standing on their own [illegible] also the quantity of cocoons obtained.

The Ministry of Agriculture will further proceed to the institution [illegible] cultural Stations and model silkworm breeding establishments and [illegible] with these institutions it will establish courses in silkworm rearing [illegible] the Lower Schools of Agriculture, designed with a view to the issue [illegible] to the students. Ovens will also be constructed for the suffocation of the [illegible] and the drying of the cocoons, and special plants for the selection [illegible] ter preservation of the cocoons. A certain quantity of the cocoons [illegible] by the Government will be distributed by the Ministry of Agriculture [illegible] price to persons establishing new spinning mills of from one to [illegible] money prizes will be awarded to the best breeders and also bursaries for study abroad. A Special Sericultural Service has been instituted [illegible] Ministry constituted as follows: 1. a body of special officials; 2. [illegible] agriculture and regional experts; 3. the communal [illegible] cretaries; 4. other officers of the same Ministry with special powers [illegible] need.

[illegible] **San Salvador: Measures for the Encouragement of [illegible] ture.** — Decree approving the Convention of Central America for the [illegible] tion of Agricultural and Zootechnical Experiment Centres. — Decree [illegible] premiums to growers of [illegible]. (*Diario Oficial*, No. [illegible] and [illegible].)

[illegible] **Kingdom of the Serbs, Croats and Slovenes: Seed [illegible] and Viticulture.** — In the *Službene Novine* (Nos. [illegible] and [illegible]) the [illegible] ing have been published: a regulation as regards the establishment and [illegible] of stations for the selection of seeds intended for sale and supplied [illegible] tion issued in pursuance of articles [illegible] and [illegible] of the law [illegible] cember 1921 (See *Annuaire International de Législation Agricole* [illegible]) dealing with the improvement and encouragement of viticulture [illegible] nally a regulation on the wine-making stations on the lines of the law [illegible] December 1921 quoted above.

[illegible] **Switzerland: Legislative Measures against Cattle dise[illegible]** A Federal Decree prohibits, pending further legislation, the importa[illegible] cattle whether for breeding or for dairy purposes except in special cases [illegible] licenses to import animals may be given in the interests of [illegible] breeding and improvement of breeds. Special regulations are laid [illegible] regard to the bringing into Switzerland of butchers' beasts or fresh meat [illegible] is prohibited when the conditions of the country from which the [illegible] meat comes are such that there would be a risk of bringing cattle disease [illegible] Switzerland, or spreading disease in that country. (*Recueil des Lois Fé*[illegible] No. 16, 11 June 1924).

...nt Stations and Agricultural Instruction.

The Pan-Pacific Research Institute. — The Castle Home, in ...u, is to be transformed into a scientific institute known as the Pan-...Research Institute. The students of the Institute will, it is expected, ...he University of Hawaii, where they will take their degrees.

...s institution will form the nucleus of the Pan-Pacific University, for ...charter was granted some years ago. This will be a graduate univer-...ity for research work. The work of the Institute itself will be along ...research study of the food resources of Pacific lands and of the ocean ...It will be connected with no other body, but will co-operate with kin-...titutions in all Pacific lands. It will be neither American, Hawaiian ...nese, but governed by scientists from all the Pacific regions.

...Castle Home will have accomodation for about forty workers, students ..., and some forty visiting research scientists, and will be provided with ...annexe specially planned for laboratory uses. There will be also other ...buildings and a good supply of water for laboratory purposes. (*Science*, ...ies, Vol. LX, No. 1548, 1924).

Germany: The Higher Horticultural Institutes of Berlin-...n, Geisenheim am Rhein and of Proskau. — The *Landwirtschaftliche ...er* publish in full, three reports on the work of these three institutes ...years 1922-23. The report of the *Hohere Gartnerlehranstalt* of Berlin-... has been prepared by the Director Professor ECHTERMEYER and inclu-... Report on administration and instruction; *B.* Report on the technical ... Report on the scientific work. Professor MUTH is responsible for the ...f the *Hohere staatliche Lehranstalt für Wein- Obst- und Gartenbau* of ...im am/Rhein, which is in four parts, viz. I. Details of the number of ... etc. II. Internal Activity of the Institute; III. Activity of the Scien-...tion IV. Work of the Vine Grafting and Improvement Station of ...em.

...report on the Proskau *Hohere staatliche Lehranstalt für Obst-und Gar-...* ...s been compiled by the Director, Herr ZEININGER, and is divided into ...rts: *A.* General: *B.* Technical work; *C.* Scientific Worl.

Austria: Experimental Station of Agricultural Chemistry ...yrol. — This station has been lately established and attached to the ...ricultural Institue. It is carried on as an institution for joint research ...ducts practical as well as purely theoretical experiments. Analyses of ...ural products of any kind are undertaken for agriculturists on appli-... (*Chemiker-Zeitung*, Year 48, No. 146, 1924).

Belgium: Agricultural Education in Belgium. — The Belgian ... of Agriculture and Public Works has presented to the Legislative Cham-...ennial Report (1921-23) relating to the position of agricultural education ...m. The Minister states that the triennial period covered by the Report ...n especially characterized by the extension of agricultural education of ...ermediate and primary grades. The most important steps taken have ...e independent powers secured by the law of 26 December 1923 to the ...ttached to the Laeken *Institut Supérieur d'économie ménagère agricole* ...Vilvorde *École d'horticulture*, and to the *École moyenne pratique d'agri-*

culture at Huys, and also the inauguration of training courses for the [illegible] staff of the different categories of schools.

In the three years the total credits voted by Parliament for agricu[illegible] education have been apportioned as follows: instruction in agriculture [illegible] francs; publicity vork 5,628,731 francs, subsidiary institutions [illegible] fra[illegible] Agricultural education has not only helped to bring about an improveme[illegible] the conditions of rural life, but also has had an effect on agricultural produc[illegible] by making more widely known the advantages of chemical fertilisers, encouraging the formation of credit and mutual insurance associations, breeders' societies, and of societies for joint purchase and sale, etc.

A number of appendices are attached to the report dealing with the fo[illegible] lowing subjects: I. The Higher Council for Improvement of Instructio[illegible] Agriculture and Horticulture; II. Agricultural Instruction for young stockfa[illegible] ers; III. Farmhouse management instruction; VI. Instruction in hortic[illegible] ture; V. Institutions closely connected with agricultural education.

For the purposes of higher agricultural education the two Government [illegible] stitutions; are recognised, viz. the Gembloux *Institut agricole de l'Etat* and Ghent *Institut agronomique de l'Etat*; for intermediate education, the *E[illegible] moyenne pratique d'agriculture d'Etat* at Huys, the schools and agricultural s[illegible] tions not under State management but in receipt of grants; the courses in sci[illegible] tific agriculture at the high schools, at the government intermediate scho[illegible] and at the non-government institutions for intermediate education; for e[illegible] mentary education, the vocational agricultural sections for boys in the prima[illegible] schools, the schools of farm engineering and the seasonal agricultural cour[illegible] for youths; and finally for popular instruction, the lectures given the Gove[illegible] ment agricultural experts, the lectures on agriculturefor adults, the courses [illegible] agricultural science for ex-service men, poultry-keeping and bee-keeping cour[illegible] demonstrations in the proper rationing of live stock, the experimental pl[illegible] and the agricultural libraries.

As regards instruction in farm household management different grades [illegible] instruction are proposed as follows: higher instruction (the Laeken *Institut n[illegible] mal supérieur d'économie ménagère agricole*), intermediate instruction, prima[illegible] instruction (young girls' courses, and travelling schools), and popular instru[illegible] tion (Women Advisers on Farm Household Management), *Conseillères mén[illegible] gères agricoles*).

Intermediate and higher instruction in horticulture is given by the Gover[illegible] ment Schools of Ghent and Vilvorde and by the grant aided schools of Ca[illegible] burg, Liège, Tournai, Wetteren, Hechtel, Louvain, La Hulpe, Maria[illegible] Bons, while lower intermediate instruction is given chiefly in the agricultu[illegible] seasonal schools and in the vocational horticultural courses. There are [illegible] horticultural courses complete in two lessons, lectures on pomology and [illegible] fruit-growing in general; a Service of Horticultural Advisers (*Conseillers d'h[illegible] ticulture*) has been is instituted, and a large subsidy towards these [illegible] instruction is given by the Government Botanic Gardens.

Institutions closely connected with agricultural education are also d[illegible] with in the report in a special appendix classified under the following [illegible] (a) agricultural chemistry and physics; (b) the dairying industry; (c) phy[illegible] pathology; (d) agricultural entomology; (e) rural engineering; (f) for the [illegible]

-ement of seeds: (g) experimental agriculture at Hasselt; (h) forestry; (i) seed-esting at Louvain.

The report contains about fifty illustrations showing school buildings aboratories, experimental demonstrations, etc. (*Situation de l'Enseignement Agricole.* Rapport triennial présenté aux Chambres législatives par Monsieur le Ministre de l'Agriculture et des Travaux Publics, 1921, 1922, 1923).

157. **Brazil: Two new Experimental Stations.** — A new Experimental Station is to be established in the municipality of Porto Felix (State of São Paulo) to be usd for investigations into questions of cotton-growing, and a second in the State of Bahia for experiments in the cultivation of cacao. For he latter Station the Government has purchased the estate "Pancada Formosa". (*Brazil Ferro-Carril,* Year XV, Vol. XXVII, No. 372).

158. **Spain: Popular Agricultural Instruction at Madrid.** — An announcement of a short course of agriculture appears in a recent number of the *Madrid A. B. C.*, to be held in the *Casa de Campo* from 1 February to 10 March f this year for young people of both sexes over 14 years of age, who have passed through the elementary school. A course on similar lines will follow from 1 March to 1 May dealing with the care and feeding of live stock with special reference to the more fundamental requirements of hygiene and sanitation and n addition instruction in the first principles of cheese-making will be given. A third course on poultry and bee-keeping will take place from 1 April to 1 May. The general Association of Spanish Stockbreeders (*Asociación General de Ganaderos*) is responsible for establishing these courses.

159. **United States: The Fiftieth Anniversary of the Forest Experiment Station at Colorado Springs.** — The Fremont Forest Experiment Station, which was established by the United States Department of Agriculture t Colorado, celebrated its fiftieth anniversary in 1924. It is the second station f its kind established in the western forest regions of the country, and has for number of years been conducting a number of laboratory experiments. The field depot of the station is on Mount Manitou. Besides the laboratory experiments, a considerable part of the work of the station is distributed over the national forests of Colorado, Wyoming, South Dakota and Nebraska, where field tests are made and permanent plots established to determine the best practical methods of re-afforestation, the rate of growth of stands, the best methods or thinning stands and for obtaining natural regeneration of forests. (*Science,* N. S., Vol. LX, No. 1560, 1924).

160. **Forest Experiment Station in the Pacific Region (United States).** — The Forest Service of the Department of Agriculture of the United States has established another Experiment Station in the North-West region of he Pacific Coast, on similar lines to that lately opened in 1923 in the North-East regions and the Lake States. (*Experiment Station Record*, Vol. 51, No. 2, Washington, 1924).

161. **Scientific Methods of Forestry in the Harvard Forest, Petersham, U. S. A.** — To observe scientific methods of growing timber crops as developed during the past 15 years in the historic Harvard forest at Petersham, he North-eastern Forest Research Council and a Committee of the pulp and paper industry met there on September 4 and 5. The Research Council was appointed by WALLACE, Secretary of Agriculture, in the previous winter, for the

purpose of promoting forest research and of working out more reliable meth[ods] of growing timber in the forests of the Northeast of the United States. T[he] Committee is acting in an advisory capacity to the Northeast Forest Exp[eri]ment Station, forest schools, State forestry departments and other forest [re]search agencies in the northeast. In addition to studying the successful [for]estry operations carried out by Harward University on intensive meth[ods] of forestry management, the conference also discussed present and prop[osed] forest research programmes, the sites for substations, and the Clarke Mc[Nary] forestry bill passed by the last session of the Congress (*Science*, N. S., Vol. [...] No. 1655, 1924).

162. **United States: Lehigh Research Institute.** — The Lehigh [Uni]versity has established the Lehigh Institute of Research, under the managem[ent] of a Board of Directors of which each man is an authority in his special fi[eld]. One of the objects of the new Institute is to afford training in reaserch to vari[ous] classes if individuals who have received a scientific education. (*Engineeri[ng] World*, Vol. 59, No. 10, p. 16. New York, 1924).

163. **Course of Lectures at the Pittsburg Industrial Research In[s]titute. (U. S. A.).** — A course of lectures is being held for the academic y[ear] 1924-25, at the Mellon Institute of Industrial Research, which is attached [to] the University of Pittsburg. It covers a number of subjects, dealing w[ith] raw materials, manufacturing, transformation processes, properties and uses [of] products of technical chemistry. Among the lectures which deal with branc[hes] of agriculture the following may be mentioned: Insecticides and fungici[des] (O. F. HEDENBURG); fertilisers (H. N. MYERS); timber preservatives (A. [...] HOWALD); Rubber (H. W. GREIDER); sugar (D. K. TRESSLER); cereal produ[cts] (H. A. KOHMAN); preserved foods (E. R. HARDING).

164. **Colorimetry at the National Bureau of Standards in Washin[g]ton, D. C.** — The Munsell Research Laboratory of Baltimore has establis[hed] two positions of research assistant in colorimetry to be stationed at the N[a]tional Bureau of Standards at Washington, D. C. The chief purpose of th[e] assistantships is to provide for training suitably qualified young men in the pr[ac]tice, technique, and theory of colorimetric measurements, in order that th[ey] may become eligible for posts of responsibility in connection with work [of] this kind. These assistants will work in the Section of colorimetry of the B[u]reau of Standards, and will be in close contact with the work of the Sectio[n] and will have unusual opportunities of learning by experience, observation a[nd] conference with other members of the staff. The work of the Section inclu[des] spectrophotometry by various methods, colorimetry and research in vis[ual] psycho-physics. The chief duties attaching to these posts will be to assist [in] research and testing involving the use of the spectrophotometer, the mon[o]chromatic colorimeter and various other photometric and colorimetric [in]struments used in testing and research. (*Science*, N. S., Vol. LX, No. 1[...], 19[24]).

165. **Official Agricultural Institutions at Haiti.** — The Techn[ical] bureau of the Department of Agriculture, for which an appropriation [of] $[...] has been made, is now being organized. A Central Section will [be] instituted for the training of technically educated men for Government and p[ri]vate service, and of teachers for agricultural schools. There will also be a [...] experimental station and branch experimental and demonstration farms [...]

e organized in localities especially adapted to coffee and cotton production nd cattle raising. The bureau will inaugurate work in forestry and the conrvation of forest products. (*Bulletin of Pan-American Union*, July 1924).

166. **Elements of Agriculture for the Lower and Rural Schools f Haiti.** — A hand-book entitled "*Premiers Elements d'agriculture à l'usage des écoles primaires, urbaines et rurales*" has been published by Dr. DALENOUR, one of the leading doctors of Haiti. The book is about a hundred pages ong, is written in a clear style, suitable for young readers, and covers all that necessary for them to know of the first principles of agriculture, with special gard to the agricultural conditions of Haiti. Elements of physics, chemistry, eteorology, botany and geology are simply explained, then follows the elementary principles of improvements, drainage, irrigation, the preparation of gricultural land, fertilisers and schemes of rotation of crops. Special attention naturally given to the crops of Haiti, rice, maize, cotton, banana, coffee, cao, tobacco, etc. and they are treated at some length, while plants used the dyeing or tanning industries, and medicinal plants are not neglected. hapters are given to cereal cultivation, forestry, horticulture and fruit-growg, as well as to the oil-yielding plants, forage plants, rubber, etc. The maual concludes with notes on the breeding of animals (including bee-keeping d pisciculture), farm book-keeping and Haitian rural economy. (DALENOUR F. Premiers éléments d'agriculture à l'usage des écoles primaires urbaines rurales. 16mo, pp. 110. To be obtained from the author, Port-au-Prince).

167. **Model Farm in Panama.** — A contract has been drawn between the ecretary of Public Works of the Panama Government and Walter C. Staton r the operation of a model farm in the district of Alanje, Chiriqui Province, here 18 students, two from each province, are to receive instruction in agricural work. Cultivation and improvement in the methods of raising rice, corn, eans, sugar cane, bananas, tobacco, and other tropical fruits and vegetables, s well as feed and forage for cattle, are among the principal subjects in which struction is to be given. Attention will also be given to proper methods of ring for livestock and the use of modern agricultural machinery.

Under the terms of the contract, which is for the period of one year from pril 15, 1924, but renewable for an addtional five years, the contractor is to ceive the sum of $36 a month for each student.

The Government reserves the right to establish an agricultural experiment ation, not to exceed 10 hectares (about 25 acres) in area, within the limits of e model farm and to place in charge an expert to be appointed by the Govnment, if desired.

168. **France : Vocational School for Shepherds at Rambouillet.** — his school is attached to the *Bergerie Nationale* at Rambouillet. Traing is undertaken of : (1) shepherds who have good practical experience and n give all the attention required to the profitable management of the flock, nd at the same time are capable of understanding the various systems of sheepaming and of giving skilled assistance when necessary ; (2) shepherds who can rm at a profit flocks put under their care or which they may farm for themseles. For information, apply to the Directeur de la Bergerie, Rambouillet eine et Oise), France. (*Bulletin de la Société des Agriculteurs de France*, 215, 1924).

169. **The Microbiological Course at the Pasteur Institute, Pa** — This course opened on 5 January of this year and will continue till 1. A. It is intended especially for doctors, veterinary surgeons and biologists desire to obtain a complete training in protozoology and in bacteriology teaching staff includes some distinguished names in the different subj CALMETTE, DUMAS, LEGROUX, POZERSKI, VALLÉE, TISSIER, MORAX, DUJAR BEAUMETZ, SERGENT, COLONI, DOPTER, SALIMBENI, BORREL, LEVADITI, P TIT, WEINBERG, LOISEAU, MARCHOUX, MESNIL, ROUBAUD, MARIE, CH. NI In addition to subjects relating to the theory and the general technique of crobiological work, and those which bear on human and animal patho attention is being paid to agricultural microbiology, micro-organisms of soil and of the residual waters etc. and the syllabus of work is so far exten as to cover questions relating to the phycomycetes, the ascomycetes, and hyphomycetes, and the *fungi imperfecti*.

170. **Great Britain. Agricultural Education and Research.** — Government has decided to provide another £500 000 for agricultu education and research, in addition to the funds already available for th purpose (amounting to £1 000 000) under the Corn Production Act, 19 and about £400 000 from other Governments. The new sum is for u during the next five years. (*The Agric. Gazette and Modern Farming*, Vol No. 2647, 1924).

171. **Dairy Experimental Institute at Reading, England.** — T National British Institute was founded in 1912 and new buildings have la been added to the special Station at Shinfield, near Reading, thus providing experimental farm, chemical and bacteriological laboratories, etc. The Ins tute possesses a library of 2000 volumes on which £30 000 sterling have be spent. (*Chem. Zeitung*, Year 48, No. 146, 1924).

172. **Agricultural Experiment Stations in Canada. (Report of D rector of Agriculture for year ending March 31, 1924).** — The *R port* covers the work for the past year, of the Central Experiment Farm, Ottaw and the numerous Branch Farms and Stations throughout the Domin (Ministry of Agriculture, Ottawa, Dominion of Canada, 1924).

173. **Phytopathological Laboratories in Canada. (Report of th Dominion Botanist for year ending March 31, 1924).** — The *Report* cove the work carried out during the year at the Central Laboratory, Ottawa, a the various phytopathological laboratories of the Dominion. An account forest tree diseases is included. (Ministry of Agriculture, Ottawa, 1924).

174. **Canada: Reports of the Chief Supervisor on the Illustratio Stations for 1923.** — The *Reports* are two in number, the first dealing wi the work of the Illustration Stations in Ontario, Quebec, New Brunswi Nova Scotia and Prince Edward Island; the second covers the work of the Sta tions in British Columbia, Alberta and Saskatchewan. (*Ministry of Agricultur*, Ottawa, 1924).

175. **Foundation for Agricultural Experiment and Research i Italy.** — The purposes for which this Foundation has been inaugurated Rome and converted into an independent institution with corporate rights b a Royal Decree of 15 August 1924 are: (1) to make grants to the Agricultur Experiment Stations with a view to the encouragement of their developme

and the due co-ordination of their activities; (2) to provide the funds required for the working of an Institute of Agricultural Economics and Statistics, set up by Decree of 30 December 1923. The capital of this Fund is formed from the funds of the suppressed Institute of Dairying, Agriculture and Stockbreeding at Rome, together with any funds that may possible be assisgned to it at a later date. (*Gazzetta Ufficiale*, 4 October 1924; *Bollettino del Minis ero dell'Economia Nazionale*, Year 2, No. 2, 1924).

176. **Transformation of the Royal Experimental Wine-Making Depots of Barletta, Velletri and Noto.** — These institutions were by Royal Decree of 19 June 1924 transformed into self-governing consortia with corporate existence. (*Gazzetta Ufficiale*, 4 July, 1924).

Associations and Agricultural and Scientific Institutions.

177. **France: International Bureau of Epizootics.** — By the decision of the International Conference which met at Paris in 1921, it was resolved that an International Bureau should be established in Paris to consider control measures for infectious diseases in animals. The main lines of the work of this Bureau were defined by the Conference, and M. M. LUTRARIO, POITEVIN and LECLAINCHE were instructed "to place themslves at the disposal of the competent French authorities to assist in the formal drawing up of the scheme as agreed upon.

Acting on these instructions, LECLAINCHE prepared a draft constitution which was submitted to the Ministry of Foreign Affairs which undertook to obtain the support of the Foreign Governments. Negotiations were actively pushed forward in view of the time necessarily entailed by correspondence through diplomatic channels with States in different parts of the world. At the beginning of the present year a number of States had signified their support so that it was possible to draw up the International Agreement the text of which is given below, as also that of the definitive Statutes.

Forty-two States took part in the Conference of 1921, and twenty-eight have already agreed to take part in the establishment of the Office while the adhesion of others is expected. India and Ireland have already signified their acceptance of the Agreement. The suggestion made by the Conference of 1921 that the new office should be attached to the International Bureau of Public Health has not been adopted, in consequence of reservations made by some of the States adhering to the latter. The International Bureau of Epizootics has thus full independence. A bill will be introduced as soon as possible for the ratification of the Agreement which has been concluded and the whole scheme will very shortly be carried into effect.

INTERNATIONAL AGREEMENT FOR THE FORMATION AT PARIS OF AN INTERNATIONAL BUREAU OF EPIZOOTICS. — The Governments of the Argentine Republic, of Belgium, Brazil, Bulgaria, Denmark, Egypt, Spain, Finland, France, Great Britain, Greece, Guatemala, Hungary, Italy, Luxembourg, Morocco, Mexico, the Principality of Monaco, the Netherlands, Peru, Poland, Portugal, Rumania, Siam, Sweden, Switzerland, the Republic of Czeco-Slovakia and the Regency of Tunis, being of opinion that it is desirable that an International Bureau of Epizootics should be organised on the

lines laid down in the resolution passed by the International Conferenc Epizootics, on the 27th May, 1921, have decided to conclude an agreem to the following effect.

Art. 1. — The High Contracting Parties pledge themselves to found maintain an International Bureau of Epizootics with headquarters at P

Art. 2. — The Bureau works under the authority and control of a Comm tee composed of the Delegates of the contracting States. The composi and competence of this Committee, as well as the organisation and power the Bureau itself, are defined by the Articles of the Constitution attached to present agreement and of which it is to be regarded as forming an integral p

Art. 3. — The initial expenses of establishing this Bureau as well as initial cost of working and maintenance are met by the contributions of the c tracting States which are fixed in accordance with the conditions speci under the Articles of Constitution referred to in Article 2.

Art. 4. — The sums representing the contributions of each of the contr ing States are paid by them, at the beginning of each year, through the Mini of Foreign Affairs of the French Republic, into the *Caisse des Dépôts* at Pa whence payments will be made as required on the order of the Director.

Art. 5. — The High Contracting Parties reserve to themselves the right introducing, by common consent, into the present Agreement, any modifi tions which experience proves to be necessary.

Art. 6. — The Governments who are not signatories of the present Agr ment may become so on application. Such adhesion shall be notified through diplomatic channels to the French Government, and by it to the other contra ing Government, and this adhesion will carry with it the obligation of contrib ing to the expenses of the Institute, under the conditions specified in Art. 3

Art. 7. — The present Agreement will be ratified under the following c ditions :

Every power shall send its ratification with the least possible delay to t French Government whose business it will be to inform the other signator

The ratifications will be deposited with the archives of the French Gover ment.

The present Agreement will come into force, for each signatory countr on the day on which that country deposits its deed of ratification.

Art. 8. — The present Agreement is concluded for a period of seven yea among the States which shall not have given notice a year before the expi of any period of their intention of withdrawing them.

In pledge of which the undersigned, being duly authorised, have made t present Agreement in single copy to which they have attached their signatur this copy will deposited in the archives of the French Government and copi of it will be sent by diplomatic channels to the Contracting parties. The s copy may be signed up to 30th April, 1924, inclusive.

(*Signed by the Delegates of various countries*).

THE ARTICLES OF CONSTITUTION OF THE INTERNATIONAL BUREAU OF EPIZOOTIC

Art. 1. — The International Bureau of Epizootics is instituted at Pari in dependence on the States who agree to participate in its working.

Art. 2. — The Bureau may not concern itself in any way with the internal affairs of the various States.

It is independent of the Authorities of the Country in which it is instituted.

It is in direct correspondence with the Higher Authorities of Services which in the different countries are responsible for the sanitary measures in regard to animals.

Art. 3. — The Government of the French Republic on the request of the International Committee referred to in Article 6, will do all that is necessary to obtain recognition of the Bureau as an institution of public utility.

The principles of the Bureau are the following :

(a) To encourage and coordinate all forms of investigation and experiment, relating to the pathology and the prophylaxis of the infectious diseases of animals, for which purpose it may appeal for international co-operation.

(b) To collect and report to the Governments and their Health Departments facts and documents of general interest concerning the occurrence of the epizootic diseases and the control measures adopted.

(c) To consider drafts of international agreements relating to sanitary measures in regard to animals and to place at the disposal of the Governments which have signed such conventions the means of supervising their execution.

Art. 5. — The Governments shall send to the Bureau :

(1) By telegraph, notification of the first cases of cattle plague or epizootic foot-and-mouth disease reported in any country or district hitherto immune.

(2) At regular intervals, bulletins in accordance with a model adopted by the Committee with information on the existence and the extent of the diseases enumerated in the following list : Rinderpest, foot-and-mouth disease, contagious pleuro-pneumonia, anthrax, sheep-pox, rabies, glanders, malignant coital disease, swine fever.

The list of the diseases for which one or the other of the preceding clauses are applicable may be revised by the Committee subject to the approval of the Governments.

The Governments shall notify to the Bureau the measures which they are taking to control epizootic diseases, especially those which they are adopting at the frontiers to protect their own territory against introduction of such diseases from infected countries. As far as possible they will reply to requests for information which are referred to them by the Bureau.

Art. 6. — The Bureau is placed under the authority and the Control of an International Committee which is composed of representative technicians appointed by the contracting States in the proportion of one representative for each State.

Art. 7. — The Committee of the Bureau shall meet periodically at least once a year. No limit is placed on the duration of these meetings. The Members of the Committee elect by ballot a chairman who remains in office for three years.

Art. 8. — The working of the Bureau is carried on by a salaried staff including :

(1) The Director ;

(2) Technical Officials ;

(3) The necessary office staff.

The Director is appointed by the Committee.

The Director is present at the meetings of the Committee and has a consultative vote. The appointments and the dismissals of the employees of any category rest with the Director who is responsible in this respect to the Committee.

Art. 9. — The information obtained by the Office is reported to the contracting State by means of a bulletin and special communications which are forwarded either officially or on request.

The notifications relating to the first cases of rinderpest or epizootic foot and mouth disease are transmitted by telegraph, as soon as received, to the Governments and the Health Departments.

The Bureau publishes regularly the results of its activities by means of official reports communicated to the contracting States.

Art. 10. — The Bulletin which is published at least once a month includes:

(1) The laws and the general and local regulations published in the various countries relating to the transmissible diseases of cattle;

(2) Notices on the occurrence of infectious diseases of animals;

(3) Statistics relating to the health conditions of the world's live stock.

(4) Bibliographical notices.

The official laguage of the Bureau and of the bulletins is French. The Committee may decide what parts of the bulletins shall be published in other languages.

Art. 11. — The necessary working expenses of the Office are borne by the signatories of the Agreement, and by those who shall subsequently adhere to it: the proportion of the contributions is fixed in accordance with the following groups:

Group	I,	in the ratio of		25	units
"	II,	"	"	20	"
"	III,	"	"	15	"
"	IV,	"	"	10	"
"	V,	"	"	5	"
"	VI	"	"	3.	"

on the basis of 500 francs per unit.

Each State is free to chose the group in which it elects to be placed. It is open to any State to transfer to a higher group subsequently.

Art. 12. — A sum is set aside from the yearly receipts for the formation of a reserve fund. The amount of this reserve, which must not exceed the amount of the yearly balance, is invested in State funds of the first rank.

Art. 13. — The members of the Committee receive an indemnity from funds assigned for the working expenses of the Office. They also receive a voucher of attendance for every meeting of the Committee which they attend.

Art. 14. — The Committee fixes the sum to be set aside each year out of the balance as a contribution to a pension fund for the staff of the Bureau.

Art. 15. — The Committee votes the annual budget statement of accounts and approves the expenditure. It also establishes the staff regulations, and makes all the arrangements necessary for the working of the Bureau.

The regulations and provisions referred to are communicated by the Committee to the contracting States and cannot be modified without their consent.

Art. 10. — A report of the administration of the Bureau is presented every r to the contracting States after the close of the financial year.

178. **Committee on Social Welfare and Agriculture in Colombia.** — Colombian Parliament has appointed a committee of its members for the pose of preparing and presenting a bill containing practical legislation on h problems as wages, workers accidents, health measures in factories and mercial establishments, medical attendance for workers, etc. The Comtee will also prepare a bill on the legislation which should be adopted in er to develop the national resources of the country to better advantage, and provide adequate means of establishing credit for the benefit of the farmer. *ll. of the Pan-American Union*, Washington, D. C., May 1924).

179. **National Institute for Colloid Research in the United States.** The National Institute, founded under the auspices of the National search Council, will form a part of the University of Wisconsin. There capital appropriation of a million dollars, which, by providing fully equipped oratories, will enable 40 to 50 persons to carry on research work. The ual upkeep and the salaries of the directors, the assistants and general ff is calculated at from 37,500 dollars, and in addition 10,000 dollars will be aside each year for the purchase of new apparatus. The Institute will be erned by a Committee of 7 members, two of which will be appointed by the iversity of Wisconsin, and the others respectively by the National Research ncil, the American Chemical Society, the Federation of Societies of Biology l Experimental Medicine, the American Society of Physics and also by the nors. (*Revue Générale des Colloïdes*, Year 2, No. 9, Paris, 1924).

180. **The Centenary of the Franklin Institute and of the Rensser Polytechnic.** — The centenary of the Franklin Institute was celebrated Philadelphia on 17-19 September 1924. Some of the most distinguished cialists in physics and engineering were among those present, or otherwise e their support. On 3-4 October there was celebrated the centenary of the nsselaer Polytechnic Institute, another of the oldest of the scientific and eneering colleges founded in Anglo-Saxon countries.

181. **The American-Albanian College of Agriculture and Trade.** The Albanian Government has made a grant of 1200 hectares of land to a v American College which takes the title of the American-Albanian Cole of Agriculture and Trade. (*Science*, N. S., Vol. LX, No. 1550, 1924).

182. **Poultry keeping in Algeria.** — A Poultry Breeding Society has n formed in Algeria of which the objects are : the protection of the general erests of poultry raising as an industry, as an agricultural resource and as obby ; the study and valuation of the different breeds of poultry, as also of thods of breeding and production ; the improvement of the strains of farmd animals, fowls, pigeons, rabbits, etc. ; discovery and care of ornamental all birds suitable for aviaries ; the increase and protection of birds useful to farmer ; and the encouragement of birds suitable for restocking game preves. (*Revue Agricole de l'Afrique du Nord*, Year 22, No. 269. Algiers, 1924).

183. **Progress of the Empire Cotton Growing Corporation.** — At general meeting of the Empire Cotton Growing Corporation held on 23 tober 1924, a report was approved which dealt with the activity of the rporation in India, Australia, South Africa, Soudan, Uganda, Tanganyka,

Nyasaland, Nigeria, East Indies and Ceylon. There was also a [illegible] the new quarterly Review of the Corporation, "The Empire Cotton [illegible] Review", on instruction and experimental work in cotton-growing, [illegible] question of transport and on the British Empire Exhibition (Empire [illegible] Growing Corporation, Millbank, London, 1924).

184. **The Work of the Department of Agriculture of the [illegible] Settlements and the Malay States.** — In the August 1924 number of the [illegible] *layan Agricultural Journal* of Kuala Lumpur (Vol XII, No 8), there [illegible] lished the reports of the various Directors of the different sections [illegible] of the Department, viz the Inspectorate, the sections of Chemistry, [illegible] Botany, Plant Physiology, the Mycological, Entomological, Agricultural [illegible] tations, and Practical Agricultural Services.

185. **The Institute of Agricultural Economics and Statistics [illegible] Italy.** — The *Gazzetta Ufficiale* of 18 November 1924 publishes the [illegible] of the constitution of the Institute of Agricultural Economics and [illegible] tistics, attached to the Ministry of National Economy with the [illegible] bureaux:

(1) A Central Bureau of Agricultural Statistics attached to the [illegible] of Agriculture; (2) A Bureau of Forestry Statistics, the necessary [illegible] which will be appropriated in the budget of the State Forest Estate; [illegible] reau for agricultural economic investigation.

The following are the functions to be fulfilled by the Institute and [illegible] ed to the different bureaux according to subject: (a) to make the yearly [illegible] cultural and forestry statistical returns, and to arrange for the [illegible] bringing up to date and publication of the agricultural and forestry [illegible] survey; (b) to initiate and carry out enquiries and studies in agricultural [illegible] forestry economy; (c) to encourage — in accordance with the lines [illegible] laid down — the gradual establishment of the farm accountancy [illegible] to draw up statistics from the material thus supplied; (d) to direct and [illegible] nate the work of any observers or institutions of rural economy in any [illegible] or region of Italy.

A Technical Committee which transacts its business at the Ministry [illegible] Agriculture is responsible for the administration of the Institute.

Local investigations and correspondance will be carried on by the [illegible] tute in the following way: (a) the Economic and Statistical Sections of the [illegible] vincial Agricultural Councils, wherever instituted, will act through [illegible] Commissioners for agricultural and forestry statistics. Failing these, the [illegible] velling Lectureships of Agriculture, or other bodies deputed by them, will [illegible] for agricultural statistics, and the Forestry Inspectorates, for forestry [illegible] (b) offices of farm accountancy in receipt of grants from the Institute will [illegible] locally established with a programme in accordance with the rules laid [illegible] the Institute; (c) either Higher Institutes of Agriculture attached to the [illegible] of Rural Economy, or Agricultural Societies or Provincial Agricultural [illegible] cils attached to scientific bodies may be appointed to report on rural [illegible] being subsidized and acting on a scheme laid down by the Institute [illegible] the special study of regional problems; (d) the Technical Committee [illegible] power to assign special enquiries and investigations to individual [illegible] are well-known as experts in the subject.

186. **Celebration of the Eleven Hundredth Anniversary of the [U]versity of Pavia (Italy), May 1925.** — In May next will be celebrated [the] eleven hundredth anniversary of the reorganisation of courses of study in [Pav]ia, as carried out in 825 A. D. by Lothair, King of Italy, who designed the [sch]ool at Pavia, which still flourishes as the centre of higher education in [Lom]bardy.

187. **Regulation of the Agricultural Services of Tripolitania.** — [The]se services have been reorganised on lines more nearly corresponding to [the] needs of local conditions and to the beginnings that have been made in [brin]ging under cultivation the fertile steppe zones of the hinterland. The [serv]ices are placed under an inspector, who is in charge of (1) the Bureau of [Agr]icultural Propaganda which is responsible for studying and giving effect [to t]he measures designed to improve local agriculture and stock-breeding, [and] for promoting schemes for assistance and inspection among farmers and [stoc]k-breeders, and for popularizing scientific methods of agriculture and stock-[bree]ding, This Bureau also keeps up to date and compiles the agricultural sta-[tisti]cal returns; (2) the Agricultural Experiment Institute of Sidi Mestri [which] is responsible for conducting scientific experiments in technical agricul-[ture], stock-breeding and economic agriculture; (3) a section of research in [agri]cultural chemistry and insustrial agricultural technology. The Inspector [of t]he Agricultural Services is himself under the Land Settlement Office. ([Mi]*nistero delle colonie. Bollettino di Informazioni economiche* Sept,-Oct. [192]4).

188. **The Japanese Libraries destroyed by the Earthquake.** — The [Uni]versity Library of Tokio, which was destroyed by the recent earthquake is [bein]g rapidly restored. A large number of books and other publications [hav]e been given by the Rockefeller Trust, by the University of Rome, by Ger-[man]y, Michigan, Colombia and California, as also by French, Dutch, Swiss, [Itali]an and Australian educational institutions.

Dr. FRITZ HABER of Germany, the inventor of a process of fixation of at-[mos]pheric nitrogen, has been authorized by this Government to proceed to Ja-[pan] to present as a gift from Germany to the Japanese Government a collec-[tion] of scientific books to replace in some measure what has been lost from the [Imp]erial Library.

189. **Polish National Institute of Rural Economy at Pulawy.** — [Thi]s Institute is placed under the Ministry of Agriculture, though indepen-[den]t as regards its internal management. It is administered by a Scientific [Cou]ncil composed of the heads of the different Sections, and a chairman is [elec]ted by the members from among their number.

The Section of Agricultural Chemistry deals with improved scientific and [eco]nomic methods of applying artificial manures, making experiments for the [purp]ose by field and pot cultivation. The Plant Cultivation Section makes a [spec]ial study of pure and applied genetics and employs for the purpose a large [colle]ction of plants, cereals, forage plants, potatoes and vegetables. The Horti-[cult]ural Section carriees out researches not only in its own special domain of [pom]ology but also on ornamental plants and on seed production. There is [also] a Section for Soil Science which is studying the classification of the soils of [Pola]nd, and collecting the data required for the construction of a pedological

atlas of Poland. A special Section deals with phytopathology and a link [illegible] with the Entomological Section.

Considerable development is going on in regard to the zootechnic [illegible] quiries which fall under three heads: (a) zootechnics properly so [illegible] (b) morphology, physiology and genetics; (c) stock feeding and rationing [illegible] Central Biochemical Laboratory enables the Sections which are not provided with Laboratories to study some of their problems from the purely chemical side.

190. **Organisation of Cold Storage in Russia.** — Russia, as a rich country and a producer of perishable goods has been for a long time interested in the cold storage industry, but the organisation of the industry really dates from [illegible] the year of the constitution of the first "Cold Storage Committee" attached to the Ministry of Trade and Industry. In [illegible] a special Committee was established in connection with the Society of Rural Economy at Moscow, which was later transformed in 1911 into the Special Cold Storage Committee. The two Committees organised branches all over the country, congresses, lectures and courses of instruction; they took an active part in international congresses and propaganda by means of pamphlets, printed instructions, etc., was actively carried on by their press office.

During the war the Moscow Committee built a refrigerating depot in connection with the transport of meat from east to west, and the Petrograd Committee instituted military cold storages. During the Revolution activity was checked, and the only Committee at work was the Leningrad Committee which in spite of very difficult financial conditions succeeded in issuing propagandist publications, holding a number of conferences and further in organising two experimental transports to Leningrad, one of fish from the Murman fisheries, and the other of Turkestan sheep, both to Leningrad and Moscow.

In 1920 the functions of the Leningrad Committee were transferred to the Scientific-Technical Council set up in connection with the Central Administration of the refrigerating storehouses and of slaughterhouses, but for want of funds the activity of this body was short-lived. But the requirements of the cold storage industry led to the creation, in March 1924, of a Central Interdepartmental Committee of Cold Storage, attached to the People's Commissariat of Agriculture, Moscow, and in the following May the original Moscow Committee was reconstituted. The range of action of the Central Committee is very large and includes: drafting of legislative and administrative proposals on questions of the refrigerating industry; propaganda (including courses of instruction, exhibitions, pamphlets, etc.), organisation of Congresses and participation in foreign congresses, general organisation of the industry.

Among the members of the Committee are representatives of Government institutions, scientific institutions and co-operative societies, either directly concerned in or connected with the refrigerating industry. The administration consists of five persons, whose appointment is ratified by the Commissariat of Agriculture, which must also approve all the resolutions passed by the Committee. At the present time the President is Engineer [illegible] and the Vice-President Professor A. W. RIMANSTEIN [illegible]. On the occasion of the IVth International Cold Storage Congress, held in London on [illegible] June [illegible] the Russian monthly review *Journal of the Cold Storage and* [illegible]

dustries issued a special number intended to provide an up to date account the situation of the industry in Russia. The articles of this number cover the aspects of this question, and are as follows: S. ESTRINE, The Immediate iture of the Cold Storage Industry in the U. S. S. R. and its Immense Possilities; A. W. RIAZANTZEFF, the Construction of Refrigerating Stores and of overnment Slaughterhouses; S. PODERNY and TIHOTSKY, The Construction Municipal Refrigerating Stores; C. DREYER, The Transport on the Russian ailroads of perishable Goods; P. DENISSOFF, The organisation and Inspecon in Russia of the Transport of Perishable Goods; H. TOULOUNINE, The efrigerating Stores and the Government Slaughterhouses since 1920; F. KOCH, he Sanitary Inspection of Perishable Goods in the Government Refrigerating ores; E. KARATYGUINE, Russian Cold Storage Organisations and their ork; The Central Committee attached to the Commissariat of Agriculture id its Activity. (*Bull. mens. des Renseignements frigorifiques*, Year 5, No. 7, 24).

onferences and Congresses.

191. **VII International Congress of Olive-Growers, Seville. December 19, 1924.** — This Congress succeeded that held at Nice from 14-20 October, 23, the resolutions of which were published in this Review in the same year *nternational Review of the Science and Practice of Agriculture* No. 4, p. 1138; 23). The following countries were officially represented: Algeria, Argentina ile, Egypt, France, Greece, Italy, French Morocco, Mexico, Peru, Portugal, pain, Tunis, Uruguay; also important associations for olive-oil production, anufacturers, farming and trading societies; the International Institute of griculture was represented at the Congress by the Spanish Delegate, a member its Permanent Committee.

Work of the Congress. — The reports presented will be published in full in e Official Report, which will appear in Spanish and French. The titles of the orks and the principal resolutions passed at the end of each debate are given elow.

Section 1: *Olive Growing.* — D. I. E. PRIEGO y IARAMILLO and D. J. RUZ LAPAZARÁN (Ing. Ag.): Varieties of the olive, its classification, practical eductions; — D. J. MIRANDA and D. F. DE LA PUERTA (Ing. Ag.): Olive Growg; — D. J. AGUILLÓ and G. G. QUINTANILLA (Ing. Ag.): Methods of Fertiling and Disinfecting Soils; — D. F. ULLASTRES and D. A. CANDAU (Ing. Ag.): Harvesting, Transport and Preservation of the Olive.

Section 2. — D. P. DE SOLIS (Olive grower and oil-producer) and D. A. RUZ VALERO (Ing. Ag.): Methods of Preparing Olive Oil; — D. M. VELASCO E PANDO (Industrial engineer and constructor of oil-production machinery): tilisation of the Residues; — D. J. J. DE OLMEDO and D. P. GUTIÉRREZ ALDERÓN (representing the "Asociación de Exportadores de aceitunas sevillanas"): Methods for Preserving the Olive.

Section 3: *Olive Oil Production Trade.* — D. J. CACHOT (representing the "Sindicato de Exportadores de aceite de oliva de Urgel y Campo de Tarragona"): Trade in Olive Products; — F. BILBAO y SEVILLA and D. M. DE OROA (Ing. Ag.): Statistics of Production, Consumption, Importation and Ex-

portation to various countries ; — D. J. CÁNOVAS DEL CASTILLO (General Se-
cretary of the " Asociacion de Agricultores de España) and D. L. Fell[illegible]
(Producer and exporter of olive-oil) : Trade Marks and certificates of Origin.

Section 4 : Diseases of the Olive. — D. L. NAVARRO, D. I. V. CLAR[illegible] and
D. J. NONELL y COMAS (Ing. Ag.): The more important Olive Pests and Metho[ds]
of Prevention and Control.

Section 5 : Hygiene and Nutritive Properties of Olive Oil. — D. C. FERNÁN[illegible]
(Chief of the Department of Chemistry of the " Instituto Nacional de Hygie[ne]
de Alfonso XIII ") : Hygienic and Alimentary Properties of Olive-Oil ; — [illegible]
PETTERS (Chemist) and D. J. AGUILÓ (Ing. Ag.) Refining, Purification an[d]
Mixing ; — D. G. QUINTANILLA and D. I. DIAZ MUNOZ (Ing. Ag.) : Analyti[cal]
Methods for determining Quality, Adulteration and Imitations.

Section 6. International Olive Oil Production Associations. — D. A. AGUI[illegible]
y GOMEZ ACEBO (Member of the Committee of National Economy) : Organiz[a]tions, National, International, and those which may be formed in olive-producing countries, for promoting the increase of oil production. Mutu[al] relations among the Associations themselves, of a private, official or social char[acter], with a view to facilitating the sale of olive oil and its products.

Resolutions of International Importance. — In all, 98 resolutions were pass[ed] by the six sections but only those are given which refer especially to inte[r]national activity and with which the present *Review* is also concerned ; oth[er] resolutions relating to agricultural statistics are reported in the *Internation[al] Crop Report and Agricultural Statistics*, No. 1, 1925.

Section 1, in the 4th resolution concerning the first report on the classi[fi]cation of olive varieties, approves of the formation of central commission[s] in regular communication with the District Agricultural Institutes, for the exam[in]ation of these varieties and which would report to the International Insti[tu]te of Agriculture on the work done, which will undertake the compilati[on] and publication of these reports.

As regards olive cultivation, in view of the exceptional importance to th[e] world's economy at the present time of increasing the area of olive plantation[s] in order to meet the increased demand for exportation and home consumption, hopes were expressed that new olive plantations will be encouraged and sub[]sidised, and that Governments and Agricultural societies will assist and en[]courage intensified olive-growing in the present zones of production.

Concerning the utilisation of olive residues (section 2) a resolution was pass[]ed that the Governments and Societies interested should encourage research and improvement in the methods and treatments of the residues and that in[]formation respecting residues should be published.

In section 3, in the sixth resolution regarding trade marks and certificates of origin, it was agreed that these might be useful and even necessary, but tha[t] no fixed rule should be made in this respect in order not to interfere with un[]restricted trading.

In section 4, after having considered the principal olive pests found in the Mediterranean basin, and the most practical measures for their control, it wa[s] resolved (8 and 9) to carry on further research work with a view to discovering effective solutions for the control of *Gloeosporium olivarum* and *Macrophoma dalmatica*, and (resolution 11) in order to assist investigations regarding the

tural or biological campaign against olive diseases and pests, it is consider- necessary that all the centres of agricultural research or similar institutions ould classify the parasites existing in their respective regions and publish e results obtained.

In section 5 it is resolved provisionally, until the Commission appointed r this purpose decide definitely, that the trade samples of olive oil must conform the following requirements: coefficient of refraction from 1.4663 to 1.4681; efficient of saponification from 181 to 215; iodine coefficient from 74 to 93.

Finally, in section 6, it is resolved to " establish an international orga- sation which will group the National Oil-Production Associations into a Fed- ation, the object of the organisation being to deal with questions of a tech- cal nature and with propaganda. At the same time, in the various countries, ational Associations should be formed which in due course will become an tegral part of the International Federation. The documentation will be rried out at the International Institute of Agriculture at Rome, and in the xt Congress the seat of the Federation will be decided, in the meantime it proposed that it be at Seville ".

Meetings. — Papers were readby: Messrs. V. DORE (Head of the Statistic- Department of the International Institute of Agriculture) on the work of e International Institute of Agriculture; D. G. QUINTANILLA (of the *Esta- ón agronómica Central*) on the extraction of olive-oil by the « Acapulco » pro- ss, of which he is one of the inventors; D. R. MANJARRES, on the utilisation f olive residues; D. L. SAEZ, on the influence of potash in olive-production. ther meetings, which required the aid of cinematographic films or lantern ides, were held by: the ex-Director of the *Estación Central de Patología Ve- etal*, D. L. NAVARRO, on diseases of the olive; D. J. MIRANDA, on the olive lantations on the banks of the Douro; Sr. SALVATELLA on olive oil-production achines; D. J. GAVILÁN on the nitrate industry in Chile.

Publications. — Among the publications of a technical nature distributed mong those attending the Congress were " Summary of the data on olive-oil- roduction in Spain ", prepared by the *Consejo Agronómico Nacional*, " Methods or Analysis of the Olive and Residues of the Olive-oil-Production Industry ", dited by D. G. QUINTANILLA (Ing. Ag.) and D. J. DIAZ y MUNOZ of the *Esta- ión Agronómica Central*; a leaflet on the Varieties of the Olive, with numerous lustrations, edited by D. A. FERNNÁDEZ, of the *Servicio Agronómico de So- rilla*; Bulletins of the *Estación olivarera de Tortosa*, etc.

International Competition of Essays. — Numerous specialists from many ountries sent works on the subjects of which notice has already been given in he last number of this Review. A special Commission was charged with the xamination of these works, but in view of their varied nature, rendering lab- ratory work necessary in order to judge of the efficiency of some of the meth- ds proposed, the decision of the Commission will not be made known until he necessary tests have been carried out by the Professors of the *Escuela Espe- al de Ingenieros agronómos* specially appointed for that purpose; the prize ssays will be inserted in the " Book of the Congress ", which will form a val- able treatise on the technique of olive-growing and oil production.

Olive-oil production Laboratory. — For the first time in such International ongresses, a laboratory was establised with the object of analysing olives,

olive-oils and residues of the olive-oil production industry. The *E Agronómica Central* is under the direction of Prof. Diaz Muñoz (Eng *Estación Agronómica Central*), assisted by Messrs. A. Virgili, Quesa (Jnr.) and Montero. Hundreds of analyses were made at the request public and of those attending the Congress.

Excursions to Olive Plantations and Mills at Seville and Toledo. — W view to instruction and obtaining information on this subject various ex were made and the following farms were visited : "Castillejo de Tallara "Lugar Nuevo" — "Casaluenga" — "La Plata" — the establis of the "Union Olivarera" at Carmona, the property of Marquis Aca where an opportunity was given to observe the method of extracting oil invented by the proprietor and named after him. At Jaen the Me of the Congress were able to examine the measures taken by the local S *Agronómica* and *Cámara Agricola* against the attacks of *Phloeothrips* on olives. The modern plants at Velez-Malaga, Puente Genil and the s oil-mill of Valderrama at Montilla were also visited. These excursions made to Andalusian farms to observe the methods of olive-pruning, cul tion, etc., and to see olive-oil producing establishments. Excursions also made to Toledo and Mora de Toledo.

Spanish Olive-Oil Production Exhibition. — This Exhibition was opene the 6th December on what will be the premises of the next Spanish-Ame Exhibition, in the Parque de Maria Luisa at Seville, where the exhibiti important trading firms and Agricultural Societies were shown. In two s the *Servicios Agronómicos* exhibited specimens, photographs, graphs, arranged according to the province, and thus forming a National Museu Olive Growing and Olive Oil Production.

Next International Congress on Olive-Cultivation. — In the closing ses it was resolved that Rome should be the seat of the next Congress, which take place in the Spring of 1926.

192. **The International Cattle Breeding Congress held at Hague, August-September, 1923.** — The report has just been published the important International Cattle Breeding Congress held at the Hagu September, 1923, in order to bring together prominent people connected w cattle breeding, in order to assist an exchange of ideas and the compilation interesting literature on the subject.

The Congress was divided into four sections, each of which took two su jects for discussion.

Section I : Heredity and Feeding.

(*a*) What new information is available regarding the doctrine of he dity which should be considered as important in cattle-breeding ?

(*b*) The new points of view regarding feeding.

Section II : Registration.

(*a*) What particulars should be entered in the genealogical registers in what way should this information be controlled to ensure the maxim accuracy ?

(*b*) How can milk production be regulated and is it possible to establ international regulations ?

Section III : The Intervention of the Authorities and the Work of the Associations.

(*a*) How can the authorities encourage cattle-breeding other than by veterinary measures ?

(*b*) In what way can the associations for the improvement of cattle derive practical advantage from the information furnished by science and registration ?

Section IV : Economics.

(*a*) What qualities should cattle possess in order to satisfy definite professional requirements ?

(*b*) How can the control of tuberculosis in cattle be carried out in practice and what are the results of experience on this question in the various countries ?

The first part of the Report contains an account of the discussions in the sections, based on the reports previously sent to the Organising Committee of the Congress, of which the President of the Sections gives a brief review at the opening of the meeting, while those submitting the reports give useful supplementary information.

In the second part of the Report are published, *in extenso*, the reports presented to the Congress by numerous scientific authorities. These reports are published in the language in which they were drawn up and are sometime accompanied by a summary in French, English and German.

Especially deserving of mention is the important part taken in the work of this Congress by the International Institute, represented by M. Fjelstad, Norwegian Delegate to the Permanent Committee. M. Fjelstad described the activities of the Institute in reference to cattle-breeding and allied questions. His report led the President of Section II (*b*) to express the following wish, which was adopted as a resolution : " The International Cattle-Breeding Congress, held at The Hague in August, 1923, while appreciating the work already done by the International Institute of Agriculture, and in consideration of the practical results achieved in the statistical and commercial domains of animal products, the regulation of milk-production and cattle-breeding, requests the Institute to continue and still further develop its work in the above-mentioned spheres ".

Section IV (*b*), dealing with the important question of bovine tuberculosis, passed the following resolutions :

1. In the interests of economy and hygiene, measures against bovine tuberculosis are urgently needed.

2. These measures shall be based on the initiative of the breeders interested ; the State will undertake to place at the disposal of the breeders all useful information on the nature of the disease and the prophylactic measures for its suppression.

3. The chief object of these measures will be to obtain cattle stock rendered immune by protection from all infection during breeding.

4. The State will encourage by means of grants, the formation of healthy stock to replace an infected herd.

5. Administrative measures will be taken with a view to the destruction of excrement, and the pasteurisation of skimmed milk and milk by-products.

6. The public authorities will take measures against the spread of tu-culosis, when observed on the farms of breeders who, voluntarily, adopt ventive measures.

7. The taking of action to set aside sales owing to the existence of bo tuberculosis, is to be recommended.

The following resolution was passed in the closing session of the Congr

" The Congress is of opinion that the relations established during Congress among members should not cease with the closing of the Congr To prevent this, it is proposed that each country appoint a correspondei give an address, and that the Central Office remain temporarily situate Holland.

" Proposals regarding a new Congress to be held in another Cou should be addressed to this Office ".

M. Massé, President of Section IV*a*, and M. Fjelstadt recalled the wor the International Institute of Agriculture in this connection, and it was agr that the new Office should work in close collaboration with the Instit (*Report of the Proceedings of the International Cattle-Breeding Congress or nised under the high patronage of H. M. the Queen of Holland at the Kurh at Scheveningen near The Hague, from 22 August to 4 September*, 1923.

193. **Belgium : International Conference on Tropical Rubber P ducts and allied Industries. Brussels, 1-16 April 1924.** — The Offi Report of this Conference has been published and can be obtained from " Rubber Growers' Association ", 2-4 Idol-lane, London, E. C. price 5s 6d. free. The discussions turned on questions of the production of raw rub rather than on technical and industrial points. Well known experts made portant communications on the principal problems. (*The Rubber Age* Vol. No. 7, London, 1924).

During the exhibition the Brazilian Government, represented by the H Commissioners, MM. HANNIBAL PORTO and J. A. BARBOZA CARNEIRO, arra ed for the publication of a daily report printed on good paper and with merous illustrations and statistics, giving the various aspects of the econo wealth of Brazil, the agricultural resources, the stock-breeding, mineral weal etc. and some illustrations of the intellectual movement in the country. The are 17 numbers, covering 200 octavo pages in all and each one may be said be complete in itself as regards the subject treated.

194. **Peru : Pan-American Conference on Standardization, Lim December 1924.** — This conference was called by the Pan-American Union the request of the Fifth International Conference of American States wh met at Santiago, Chile, in 1923. The Peruvian Government sent invitatio to the twenty-one republics of the Pan-American Union and to a number technical and commercial associations, both Peruvian and others. The gene purpose of this conference was to study the possibilities of developing in American and international standards for raw and finished materials as w as standardized classifications and nomenclature and to make recommendatio with regard to a gradual policy that might be adopted by governments intere ed in these important questions.

In drawing up the programme of this conference the Peruvian Governme utilized the co-operation of the Pan-American Union and Inter-American Hi

Commission and these in turn obtained the advice of representative organisations and individuals. The preparatory work on questions relating to agricultural products, both raw or manufactured was handled by the U. S. Departments of Commerce and Agriculture. The American Engineering Standards Committee undertook preparatory work among the manufactures of North America, and an advisory Committee has been set up on the request of ROWE, the Director General of the Pan-American Union. (*Science*, Vol. LX, No. 1560, 1924).

195. **Hawaii : First International Conference of Sugar Planters and Manufacturers, Honolulu, 26 July to 14 August 1924.** — In the *Louisiana Planter and Sugar Manufacturer*, New Orleans (LXXIII : No. 7, 1924), there appear notes on the work of the Conference on methods of cultivation, on varieties of cane-sugar, on the sugar industry in Australia and Fiji, on technical problems related to the industry, etc.

196. **First Pan-Pacific Food Conservation Conference, Honolulu, 31 July-14 August 1924.** — This Conference met under the chairmanship of Dr. L. O. HOWARD, Chief of the Bureau of Entomology of the United States Department of Agriculture. There were present 95 delegates : 38 from the mainland of the United States, 55 from other Pacific countries and two from the West Indies. Twelve duly appointed delegates from Hawaii and 36 residents took part in the meetings which were also attended by a number of other local persons. Altogether fourteen Pacific countries were represented by about a hundred and forty technicians of both sexes.

The Conference which was the fifth of the series designed to promote a mutual understanding by peoples of the countries round the Pacific, of the different common problems was, summoned by and held under the auspices of the Pan-Pacific Union. It was organised in seven sections, the most important of which were devoted to (*a*) the sugar-cane industry ; (*b*) fisheries, marine biology and oceanography ; (*c*) plant protection through quarantine and researches in entomology and phytopathology and (*d*) food-crop production and improvement. As a result of the discussions in the sugar-cane industry section, there was tentatively organised an international association of persons interested in the industry, and it is hoped that this association will meet at Havana in 1927.

At the final sessions thirty-three resolutions were adopted : three of these relate to the sugar industry, six to fisheries, four to plant protection, one to animal industry, four to food-crops, three to marketing problems while the rest are of a more general nature.

Classifying the resolutions on a different basis, three refer to the work of the Pan-Pacific Science Congress to be held in Japan in the autumn of 1926, six to the protection of food resources by international treaties and agreements and twelve recommend more or less specific programmes for future research.

A Committee appointed for the purpose will publish a full report of the proceedings of this important Congress. (*Science*, N. S., Vol. LX, No. 1549, 1924).

197. **France : International Dairy Congress, Paris, 1925.** — This Conference will be confined to dairy questions in relation to hygiene and food values, dealing with fresh milk, sterilized and pasteurized milk, the organoleptic qualities of milk, etc. The dairy produce industries, such as cheese-

making are not to be included. Application will be made at the Congress the ratification of the scheme already drawn up by the permanent Bureau the International Dairy Federation for the establishment of an Internati Milk Bureau at Brussels, and the adoption of a resolution to safeguard the signations of origin of milk products on the world market will be requ

198. **Belgium: International Congress on Technical Instruct Charleroi, April 1925.** — This Conference is to be organized at the Charleroi "Université du travail" by the Committee for the improvement of industrial and agricultural education, and will include a Section for techn agricultural instruction. Special arrangements are being made to en specialists of all nationalities to form an idea of the completely modern organisation and the special character, both scientific and technical and vocati of the institutions of the province of Hainault, while at the same time giv them an opportunity of judging of the application to practice of the demonstra tion courses given by the teaching staff and well-known agriculturists for students of the different institutions. Visits will be made to the establishme and it will be possible to attend the demonstrations, and in addition rep will be presented to the Congress. Enquiries should be addressed to M. LUQUESNE, Secretary of the *Executive Committee*, 45, Rue du Haut, Mons, Belgium.

199. **Canada: Third World Poultry Congress and Exhibition. 19** — In May 1924 the *International Association of Poultry Instructors and Investigators* received permission from the Government of Canada, through Canadian Minister of Agriculture, with the support of the Ontario Minis of Agriculture, the Canadian Pacific Railway, the Canadian National Railw and representatives of the United States of North America, to hold the t World Poultry Congress on Canadian soil, in 1927. Full facilities are guarant by the Dominion Government for delegates and visitors to the Congress a in particular to the poultry show to be held at the same time.

After due consideration of the question by the Council of the Internatio al Poultry Association, which inaugurated this type of Congress and in vi of the fact that the first and second Congress were both held in Europe, nam in Holland in 1921 and in Spain in 1924, it was resolved that the third sho be held in North America. The invitation of the Canadian Government w consequently accepted, and the more readily, since more than 50 % of the me bers of the International Association, all either engaged in giving instructi or in investigating poultry questions or in some special work on the subje are living either in Canada or in the United States. In these countries t there has been greater progress in the various branches of poultry-keepi in the last twenty years than elsewhere. Hence all persons who take par the Congress of 1927 will have the opportunity of visiting the North Am ican Universities and Colleges, in which the fullest instruction is given in th branch of food production, of meeting the most celebrated professors and i vestigators, of observing the methods adopted on a large scale by produc and of studying the systems in use for the marketing of eggs and poultry. Th Congress will be held under conditions peculiarly favourable from the educa tional standpoint. The arrangements for the conduct of the Congress w be published in due course and formal invitations to attend will be sent lat

Ministries or Departments of Agriculture of the different countries. In the meantime communications or enquiries may be addressed to Mr. Edward BROWN, F. L. S. President of the *International Association of Poultry Instructors and Investigators*, 20-21 Essex Street, London, W. C. The date of the Congress will be announced within the next few months.

200. **Poland: International Congress of Agriculture, Warsaw, 21-24 June 1925.** — Five Sections will be included: (1) Rural Economy; (2) Vegetable Production; (3) Animal Production; (4) Agricultural Industries; (5) Scientific Section, agricultural experiments, agricultural instruction. The subscription is fixed at 10 *Zloty* (50 French francs).

201. **German Colonial Congress, Berlin, 17-18 September 1924.** — The German review of tropical agriculture, *Der Tropenpflanzen*, has issued a special number (Year XXVII, No. 4, 1924) relating to this Congress, containing the following important articles: M. BUSSE, Agriculture in the occupied German Colonies; A. ZIMMERMANN, Retrospective Survey of the Work of the Institute of Agricultural Biology at Haman; GEO. A. SCHMIDT, Agriculture in Mexico; W. A. TH. MULLER NEUHAUS, Transport in the Tropical Regions Unprovided with Railways; O. PRENSE, The Biology of the Coconut Palm; Fr. TOBLER, The Preparation of Tropical Textile Fibres; W. RUSHMANN, Cultivation of the Tomato in Tenerifie and the Canary Islands.

202. **Brazil: Congress of the Municipalities of the State of Rio de Janeiro.** — From the point of view of rural economy and scientific agriculture the following papers read at this Congress by M. ALVANO PAES, prefect of Itaguahy are of considerable interest: (*a*) Poultry-breeding in the State of Rio; (*b*) The protection of the agricultural labourer as a factor in reduction of the cost of living; (*c*) the Co-operation of the Municipalities in the work of Rural Sanitation; (*d*) The establishment of Sanitary Engineering bodies as a means of maintaining healthy conditions in the rural districts; (*e*) Cotton growing in the State of Rio; (*f*) Reforms in Primary Education. In the *Brazil Ferro-Carril*, Year XV, Vol. XXVII, Nos. 365,. 373, 1924, the resolutions passed in the different Sections of the Congress, and also those of Section II, Agriculture and Stock-breeding and Rural Economy were published in extenso. (*Brazil Ferro-Carril*, Year XV, Vol. XXVII, Nos. 365, 367, 368, 360, 373, 1924).

203. **United States: Proceedings of the Fifty-Sixth Convention of Farmers and Fruitgrowers at Santa Ana, California.** — Important questions were under discussion at this meeting which was held on 6-7 December 1923, under the auspices of the California Department of Agriculture. The subjects relating both to the scientific and the practical side of agriculture, included reports on the quarantining of plants, intended to prevent the introduction of vegetable pests and infection into the United States, reports on immigration and agricultural labour, the problem of transport and market conditions. The Proceedings of the Fifty-Sixth Convention of Fruitgrowers and Farmers, Santa Ana, California, have appeared in a volume of 148 pages, forming Nos. 1 to 6 of Vol. XIII of the Monthly Bulletin of the Department of Agriculture, State of California, published at Sacramento, California, June 1924.

204. **Annual Meeting of the Metric Association. Washington D. C., 29-30 December 1924.** — At this meeting of the *Metric Association*, lectures were given by experts in reference to the work of the Association,

and an exhibition was held and demonstrations given of modern methods of instruction in the metric system of weights and measures. Information may be obtained prom the Metric Association, New York City.

205. **National Conference on the Utilization of Forest Products, Washington, 19-20 November 1924.** — This Conference was called by Dr. WALLACE, the Secretary of the Department of Agriculture, United States, for the discussion of the following questions: (1) the determination of the nature and extent of the present preventable wastes, in forest production, how far prevention is attainable in view of the results of research, how far better utilization is retarded not only by economic conditions, but by failure to apply available technical knowledge; (2) the nature and extent of the present unpreventable wastes, and how an enlarged programme of research may lead to improved methods of prevention; (3) the consideration of policies and measures which might be supported by industrial, professional and governmental agencies so as to insure the most efficient development and use of the forest resources of the United States; (4) the formation of a permanent advisory committee on the utilization of forest products. (*Science*, N. S., Vol. LX, No 15.., 1924).

206. **France: Thirty-first Congress of the Milling Industry. Paris, October 1924.** — The chief questions proposed for discussion were as follows: The production of wheat in France in 1924, in relation to the working capacity of the mills, and the needs of the community; the extraction percentage of the flour and the regulations there contained in the Decree of 21 August 1924, which fixes a minimum extraction rate of 78 %; the introduction of substitutes into wheat-flour; the taxation of the products of milling; the effects of the law from the point of view of commercial transactions; the acceptance of foreign grain at the French ports; the determination of the specific weight at the time of unloading the cargo, by means of the 20 litre or the Schopper balance; the drafting of a French importation contract and the establishment of an arbitration office; the Chemistry Department of the Milling Industry.

The French Shool of Milling will be opened at the same date as the Congress. Enquiries may be addressed to the Secretariat General de l'Association Nationale de la Meunerie Française; Place du Louvre 6, Paris.

207. **Italy: Viticultural and Wine-making Congress. Casale Monferrato, 7-5 September 1924.** — Reports presented to the Congress: Professor PIROVANO, New prospects in viticultural genetics; Professor BOTTO, Causes of withering in grafted vines; Professor ZAVATTARI, Viticultural Conditions of the Province of Alessandria; Professor PERSI, American Piedmontese Hybrids. There was also a report by Cav. MARINI — on the charges on wine, — and of Sig. MARESCALCHI — on questions relating to wine-making (instruction, manufacture on a large scale, transport, distillation, credit, distribution of wine to the army and navy, export trade).

Exhibitions, Fairs and Competitions.

208. **Belgium: XXVIIIth Grand International Poultry Exhibition, Brussels 24-26 January 1925.** — Enquiries to be addressed to M. Boty, Secrétaire Général, 95, Avenue Roylet, Brussels.

209. **Spain : International Sample Fair. Barcelona, Spring 1925.**

210. **France : International Poultry and Bee-Keeping Exhibition Lyons, 7-11 January 1925.**

211. **New Zealand : International and South Seas Exhibition. Dunedin, November 1925.** — Announced in the *South African Journal of Industries*, Pretoria (Vol. VII, No. 8, 1924) as financially supported by the New Zealand Government.

212. **Switzerland : Colonial and Exotic Products International Fair. Lausanne, 27 June to 12 July 1925.** — Under the patronage of the Swiss Government. Among the sections are : (*a*) Food Products of agriculture and fishing ; (*b*) Other products of agriculture and fishing ; (*c*) Horticultural produce ; (*d*) Forest products and industries ; (*e*) Mineral products ; (*f*) Colonial arts and manufactures.

213. **Uruguay : International Sheep Show, Montevideo, February 1924.** — The Show was held under the auspices of the *Uruguay Rural Association*. Sales of animals of choice breeds were effected and the prices paid for two rams were respectively 400 and 750 pesos.

214. **Austria : Alpine Agricultural Fair. Innsbruck, Tyrol, 5-12 October 1924.** — Although mainly of an agricultural character, all rural industries were here represented. The main groups were : agricultural stock-breeding, a show of cheeses, fruit-growing and gardening, bee-keeping, agricultural instruction.

215. **Belgium : Exhibition of Farm Machines and Products and Great Agricultural Week, Brussels, 14-22 February 1925.** — Organized by the Society of Farm Mechanics and Agricultural Industries, and under the patronage of the Belgian Ministry of Agriculture. The programme includes : farm machinery properly so-called, machines for cultivation ; methods of cultivation and preparation of the products ; milking machines and dairy apparatus ; various types of apparatus for preventing accidents with farm machines ; home colonization exhibits ; plant for land improvement, land drainage, irrigation, levelling, clearing, etc, ; forestry plant ; fishing, poultry-keeping and beekeeping equipment ; horticultural exhibits ; greenhouses, heating apparatus etc. ; machinery and implements for agricultural industries ; steam, petrol, wind, electric hydraulic power machines and motorcultivators ; lorries, tractors, etc. ; materials for rural buildings, and equipment ; tools and implements; farrier's instruments, harness ; fertilizers, stock feeds, dips ; instruction and diagrams relating to farm machinery ; rural electric and mechanical plants. Enquiries may be addressed to M. A. CARLIER, Secrétaire de la Société de mécanique et d'industrie agricoles, 29, Rue de Spa, Brussels.

216. **Brazil : Pernambuco Municipal General Exhibition. October 1924.** — A Bee-keeping Section showed the progress made in Pernambuco as regards the production of honey and wax, and improved methods of collection (*Brazil Ferro-Carril*, Year XV, Vol. XXXVII, No. 372).

217. **Agricultural and Pastoral Exhibition at Jaguarão, Rio Grande do Sul.** — Opened on 29 November 1924 by the local Agricultural and Pastoral Society (*Sociedade Agricola e Pastoril*). A number of Uruguay breeders took part (*Brazil Ferro-Carril*, Year XV, Vol. XXVII, No. 372).

218. **France: National Seeds Fair, Versailles, 17-25 January 192** — Under the patronage of the Ministry of Agriculture, and ... by the Federation of the Agricultural Associations of the Seine, under the ... of the Offices Agricoles of the North and of the Department of Seine ...

219. **China: French Indo-Chinese Fair, Hanoi, 30 November 14 December, 1924.**

220. **Great Britain: Textile Fibres at the British Empire Exhibition, Wembley.** — In the Manchester *Journal of the Textile Institute* (Vol. 15, No. 9, Manchester, 1924), an account appears of the Wembley exhibit of production of textile plants in the British colonies, including cotton, sisal, flax, hemp, Manilla hemp and other fibres of minor importance from the following territories, Sudan, Nyasaland, Tanganyika, Uganda, Kenya, Zanzibar, Mauritius, and the Union of South Africa. Information on the cultivation of these fibres in the different countries is also given.

221. **Gold Coast. Colonial Exhibition, March-April 1925.** — The object of this exhibition is to encourage trade between England and the territories of West Africa and to afford representatives of the manufacturers the opportunity of studying the needs of the various populations on the spot. The Exhibition will include five main sections: trade, agriculture, cultivation of orchard trees, mineralogy, arts and crafts. The products of the four colonies of British West Africa, viz., Nigeria, Gold Coast, Gambia and Sierra Leone will be shown, and the mineral exhibits of these regions will illustrate the important part taken by the mining industry in the economic development of the Gold Coast in the last 30 years. In the Arts and Crafts Section the artisans of the four colonies above-named are grouped together in one pavilion and carry on work in common.

222. **Italy: The Horticultural Conferences of the Royal Tuscan Society of Horticulture, Florence, 18 January, 15 February, 15March 19 April 1925.** — All persons taking part in these meetings have the opportunity of showing any kind of horticultural produce (plants, flowers, fruit vegetables) which they consider worth bringing to the notice of those attending the conferences.

223. **Stock Competitions at the Milan Fair April 1925.** — In the Stock show at this fair breeds of cattle will be exhibited which have not been shown at previous fairs, including the Chianina breed, the pure-bred Pelodica, the Tarin or Savoyard, the Danish. A large number of Belgian horses will also be shown.

224. **Northern Ireland: Exhibition of Flax; Lambeg, Belfast, 16 October 1924.** — This exhibition was held in connection with the experimental Laboratories of the Linen Industry Research Association. Various subjects relating to the textile plant in question were treated with demonstrations by the staff of the laboratories such as the flax stalk, the constituents of the plant, pests, etc. damaging the seeds, etc. A demonstration of the valuable work carried on by the Experimental Institute of the Association was given. (*Journal of Textile Institute*, Vol. XV, No. ..., pp. 581-582. Manchester, 1924).

225. **Switzerland: Swiss Sample Fair, Bâle, 18-28 April 1925.**

Development of Agriculture in the Different Countries.

226. **Brazil: Agricultural Development in Brazil.** — A number of questions relating to scientific agriculture in Brazil in the three years 1921-1923 are handled in a series of chapters, supplying much statistical and other information, by M. HANNIBAL PORTO, deputy to the Rio de Janeiro Council and member of the Brazilian Higher Council of Industry and Commerce. In addition to some subjects which are also af international interest, such as cotton and rice growing, the production of cacao, timber for building, animal food products, the author deals with various special questions of great importance to Brazil.

For example, a separate chapter is given to each of the following: a valuable substitute for rubber, obtained from balata, the coagulated latex of *Mimusops bidentata* D. C.. an indigenous *sapotacea* of Guiana and of the Northern Amazon locally known by the not very precise name of "massarandubas"; the vegetable ivory, obtained from *Phytelephas macrocarpa*, the "Jarina" or "Yarina" of the natives; the "guarana" or "Varana" a *sapindacea* known scientifically as *Paullinia Cupana-Hunth* the seeds of which have a high reputation as a nerve tonic; the "Brazil nut" variety "sapucaia" or *Bertholletia excelsa*, the export of which has rapidly increased while that of the Amazon rubber has diminished; the "babassu" palm the oil of which is the object of an important industry in the States of Maranhão and Piauhy.

Each chapter of the book contains statistics which, taken together, present a complete picture of the great natural wealth ot Brazil and thus provide an exhaustive economic survey. (HANNIBAL PORTO. Aspectos economicos do Brazil. Retrospecto de 1921 e 1923. Considerações sobre nossas possibilidades mercantis, pp. 303, 8vo. Rio de Janeiro, 1924).

227. **Colombia: National Reserves for Agriculture.** — In March 1924 the Government of Colombia issued an order by which the public lands in the banana zone of the Department of the Magdalena were declared national reserves to be used for the cultivation of certain products. A commission was also appointed to survey, map, and mark the boundary of these Government lands. (*Bulletin of the Pan-American Union*, p. 720, 1924).

228. **Cochin-China: Rubber Plantations.** — According to the *Comptes Rendus de l'Académie des Sciences Coloniales*, 1924, the plantations may be classified in three groups: (1) the medium sized plantations of small Government employees, or of persons employed in trade or industry, taken up as a lucky speculation on denuded lands, in the more healthy parts in the neighbourhood of native settlements. This example has been followed by a few of the inhabitants of Annam; (2) the companies installed in the Bien-Haa region, in the neighbourhood of the railways, on the red earth lands partly disafforested and infested by the "Imperata" grass which makes special methods of clearing the soil necessary. Mechanical methods of cultivation have been applied on the *Suzeenah* plantations and An-Loc, where health camps have been organized in a markedly malarial centre; (3) companies formed in 1910 and afterwards, including the "*Société des Caoutchoucs de l'Indochine*". In the laying out of these plantations Malayan methods are usually followed which are in the main those employed by the Mois for their rice plantations in the forests. The vast extent

of bamboo in the province of Thadamot facilitates the application of the methods which are of great importance for the rapid exploitation of large areas of plantation. The latter undertakings have benefited by the experiments made at Xa-Trach on lands covered with light bamboo.

Cochin-China has a very deep soil, and a dry season follows on a period of abundant and well-distributed rains and hence conditions are very favourable to the cultivation of *hevea*. In addition Cochin-China has the advantage of an exceptional supply of labour and it has proved possible to train expert assistance both for the work of clearing, and for establishing plantations and the after cultivation. (*C. R. de l'Acad. de Sc. Coloniales*, 1924, quoted in the *Revue Scientifique*, Year 62, No. 18, 1924).

229. **Italy: Italian Agriculture.** — The proposal of the American agricultural review " World Agriculture " for the publication of a number devoted to agricultural Italy and intended to make better known overseas the characteristics, the progress and the future possibilities of Italian Agriculture was supported by S. E. A. SERPIERI, Ex-Secretary of State for Agriculture. The articles intended for the American review were also published in an Italian edition of " Italia agricola ", a review edited by the *Federazione dei Consorzi agrari* which set apart for this purpose the number of October 1924. Hence this issue contains a large number of articles of a comprehensive nature dealing respectively with the following subjects: a sketch of the progress achieved in Italian agriculture (A. SERPIERI); the rural population (F. COLETTI); Italian lands (U. PRATOLONGO); characterstics of Italian agricultural economy (G. RASSINARI); the new Italian agrarian legislation (R. TRIFONE); agricultural instruction and experiment (V. ALPE); Italian agricultural co-operation (E. MORANDI); land improvement schemes (V. PEGLION); Special orchard cultivation (G. BRIGANTI); cereal cultivation (E. AZIMONTI); industrial herbaceous crops (F. ZAGO); stock-breeding (N. FOTTICCHIA); woods and meadows (M. DE BENEDICTIS). The journal is abundantly illustrated (*L'Italia Agricola*, Year 61, No. 10, 1924).

230. **Agricultural Production in Italy.** — The Hon. GIOVANNI RANIERI in a speech made in the Senate on 18 December 1924 gave an account of the grain crop and the live stock production, forestry policy, land improvements or reclamation, irrigation, chemical fertilisers, especially the nitrogenous fertilisers, and in connection with the latter called attention to the wide diffusion of the CASALE and FAUSER processes of nitrogen fixation. Other questions dealing with the increase in agricultural production are discussed in a small 16mo. volume, pp. 29, Rome, 1925.

231. **Panama: Land Settlement.** — A company which has bought 15,000 hectares of land in El Volcan, Province of Chiriqui, is engaged in subdividing and colonizing a large tract of land of which twenty-three 100-hectare lots have already been sold to colonists from California. The chief crops to be raised are coffee, sugar cane, bananas, and other fruit products. It is hoped that the Government will soon begin construction on the road from La Concepción to El Volcan, where the climate, the richness of the region, the building of a hydroelectric plant etc. will all contribute to the making of a thriving community. (*Bulletin of the Pan-American Union*, p. 725, 1924).

232. **Uruguay: Agricultural Progress in Uruguay.** — In the " message " presented by the National Council of Administration to the General Assembly of March 1924 the following report of the work of the Commission for the Promotion of Agriculture during 1923 was given. In order to comply with the requests made by agriculturists, the work of the Commission was considerably increased during the year, its chief activities including the following: Inspection of growing crops ; treatment of seeds and use of fertilizers ; manufacture and sale of insecticides and fungicides ; supply of seeds on credit ; advisory service ; inspection of orchards and vineyards ; treatment of plant diseases ; assistance to agricultural colonies ; inspection of plant nurseries ; organisation and inspection of co-operative fruit-growing societies ; ploughing competitions : co-operation in agricultural fairs and in the farm and cattle census ; plant and seed inspection at ports ; measures for the control of locusts.

Inspectors made 2446 crop inspections and 4709 inspections at ports, where 791 lots of plants or seeds were fumigated, 1252 inquiries were answered by the Central Office, and 186 seed analyses were carried out. The work of the supply department increased appreciably, 16,590 kg. of insecticides and fungicides and 3878 litres of similar products having been distributed by agents in all parts of the country. (*Bulletin of the Pan-American Union*, p. 727, 1924).

Miscellaneous.

233. **Brazil : " Curaua ", the new Brazilian Textile Fibre Plant.** — At Taperinha, near Santarem, the most important town on the Lower Amazon (State of Para), the Swiss naturalist Dr. G. HAGMANN, who has been a resident for many years in the district and is an official of the municipality of Santarem, is cultivating an extensive plantation (500 ha. 500,000 specimens) of the " curaua ", a member of the Bromeliaceae, which is reputed to yield one of the strongest textile fibres in the world. Leaves of two year old plants are already fit to be gathered and are on an average 1.20 metres long. The 500,000 plants mentioned will yield 150 metric tons which sold at the same price as " sisal " would give a return of 420 contos of reis. In the opinion of experts the fibre is suitable for making all kinds of textiles and twine. In view of the fact that on the Brazilian market there is an immense demand for textile fibres of every kind it is estimated that Dr. G. HAGMANN will be able to increase the number of his plants to 300 000, sufficient to yield 900 metric tons of fibre, bringing a return on the basis already quoted of 2520 contos de reis. (*Brazil Ferro-Carril*, Year XV, Vol. XXVII, No. 374).

234. **A New Coffee Picking Process.** — At the meeting of the *Sociedade Rural Brazileira*, held 14 May 1924, Sig. I. do AMARAL CASTRO explained a method of coffee picking which should be much more profitable than the method at present in use. He calls it " natural harvesting " (colheita natural) and the plan consists in removing from the plantation, by means of besoms or any ordinary brooms, the fallen coffee berries at periods of about two months, so as to prevent the product remaining on the ground too long. One man, with an ordinary broom, sweeps and shakes on an average 200 coffee bushes a day, thus obtaining a larger daily work yield than by the usual process. The harvest should be accomplished in two periods, and there should be a definitely calculable yield, since it would be removed from the ground at

the proper times of ripening and thus there would be avoidance of the loss a large quantity of coffee which would spoil if left longer on the ground. The process of gathering could be carried on equally well on rainy days and in hot sun; this would much facilitate the work which would hardly serve more than one minute per plant.

In the *Revista da Sociedade Rural Brasileira* (Year V, No. 48, p. 187, 19 a table is given showing a comparison of the different states of ripening of berries gathered both by the "usual" and by the "natural" process and the superiority of the latter is shown.

235. **Spain: Catalogue of Plants in the Garden of Acclimatization of Orotava (Canary Islands).** — This catalogue has been published Madrid by the Dirección general de Agricultura y Montes, Ministerio de Fomento. It is prefaced by a historical introduction, by F. MENENDEZ Ing. A (Santa Cruz de Tenerife) and is illustrated by four large illustrations representing specimens of this extensive collection.

The Garden has been in existence over a century having been founded King Carlos III of Spain by a Royal Ordinance of 17 August 1788. It is situated on the "Durazno" estate between Puerto de la Cruz and Orotava, at average height of 95 metres above the sea, and has an area of 19.749 hectares (*Catálogo de las plantas existentes en el Jardin de Aclimatación de La Orotava* Canarias, Madrid, 1923).

236. **France: The "Verdissage" of seeds.** — Attention has been drawn by M. VERMOREL, member of the Académie d'Agriculture to a method which he calls "verdissage" of seeds and which offers certain advantages as compared with the various processes now in use (sulphur treatment, treatment with formalin, Bordeaux mixture, or hot water etc.), with the object of protecting seeds from rust or smut. In the course of an enquiry made at the Ville-Franche-sur-Saone Viticultural Station, the author made an estimate of the loss in germination capacity resulting from the methods in use. The Americans who have noticed the disadvantages of the wet methods with sulphate of copper, have lately tried to substitute a dry method. The Berkeley Station has discarded copper sulphate which does not adhere properly to the seed on account of its crystalline structure,and have finally replaced it by copper carbonate.

After a number of experiments, the Viticultural Station of Ville-Franche-sur-Saone has decided on the use of neutral coppper acetate (verdigris) reduced to a fine powder in which condition it adheres well to all seeds.

100 to 150 gm. of acetate per 100 kg. of wheat is quite enough. This process of "verdissage" of seeds would be economical, practical and easy of manipulation, and would give the same security against rust and smut in the case of cereals as the other methods in use, thus avoiding serious losses of germinating capacity.

237. **United States: Construction of a Reservoir in Idaho.** — The scheme has been approved and contracts taken up for the construction of the reservoir at the American Falls in Idaho, with the object of supplying water for the irrigation of about 1 500 000 acres of land in the Snake River Valley, one of the best watered valleys of the United States. The cost is estimated at 8 000 000 dollars. The reservoir will be about 25 miles long and 11 miles wide

and the mean depth will about 40 feet. The increased value of the crops, as the result of this additional irrigation is calculated at 40,000,000 dollars annually. (*New Reclamation Era*, Vol. 15, No. 11, p. 176 Washington, D. C., 1924).

238. **United States : The Italian Silo.** — In the Experimental Agricultural Station at Wisconsin tests have been carried out by W. H. PETERSEN and L. A. BURCKLY on two examples of the Italian method of ensilage. The ensilaged forage consisted of lucerne containing from 30 to 40 % moisture and enclosed immediately on introduction into the silo. As is well known, the Italian process of ensilage consists in burying half-dried forage in trenches impermeable to water and subjecting it to rapid and heavy pressure (at least 10 quintals of weight per square metre) so as to keep it as much as possible from the air and to hinder the rise of the temperature of the whole mass. During the 100 days of ensilage the experimentors took the temperature, and the bacteriological content, at fixed intervals, and also made a chemical and bacteriological analysis of the buried lucerne. It was shown that the composition of the lucerne remained nearer to the original state, the microbiological content was lower and the fermentation temperature less than in the maize silos prepared with damp and overheated forage. (*Hoard's Dairyman*, Year 66, No. 4, p. 80, 1924).

239. **Great Britain : Yeoman II, a New Seed Wheat.** — The Council of the National Institute of Agricultural Botany, Cambridge, is placing upon the market about 2 500 quarters of a new seed wheat, Yeoman II, bred by Prof. R. H. Biffen. The wheat will be sent out in sealed sacks ; the price will be £6-6-0 per 4 ½cwt. Yeoman II is intended to take the place of the older Yeoman wheat, to which it is superior. Both wheats are products of Browick × Red Fife. Reports have stated that bread made from the flour of Yeoman II is incomparably superior to that obtainable from the average English wheat. It is particularly suitable for medium and heavy soils. (*Nature*, Vol. 114, No. 2859. London, 1924).

240. **Sugar Beet Industry.** — The Government subsidy of 19/6 per cwt. on home-grown sugar will have an immediate effect in Great Britain on the Sugar-Beet Industry. In addition to the two factories now in existence six more are to be erected, involving the permanent investment of over £2 000 000. (*The Agricultural Gazette*, Vol. C, No. 2461. London, 1924).

241. **Palestine : Afforestation in Palestine.** — Nearly 2 000 000 trees have been planted during the period 1920-1924, in which work the Forest Service has rendered valuable aid. Assistance has been given by the Zionist Executive and the Supreme Moslem Council and planting work has been done by municipalities, private persons and villagers. During the same period nearly 1 000 000 vines were planted of which 700 000 came from Government nurseries. (*The Commercial Bulletin*, Vol. VI, No. 67. Jerusalem, 1924).

242. **Canada : A Vegetation and Forest Cover Map of Canada** has been published by the Natural Resources Intelligence Service of the Department of the Interior. The map shows the different zones of vegetation, from those in the north which will support only a growth of hardy grass, to the almost sub-tropical fruit belt of southwestern Ontario. Information is given which has been obtained from the notes of both the earlier explorers and surveyors and those of more recent date. (*Scientific Agriculture*, Vol. V, No. 2, Ottawa, 1924).

243. **India: Aerial Map of the Forests of the Delta of the Irrawa[illegible]** — An aerial survey under direction of the Survey of India and Burma F[illegible] Departments of 1300 square miles of forest in the Irrawaddy Delta [illegible] undertaken in order to provide maps of the Delta forests and also to [illegible] information regarding the distribution of the different types of forests. Betw[illegible] 3000 and 4000 photographs were taken. Owing to the difficult and swa[illegible] nature of the ground the survey of these forests on the scale of [illegible] 1 mile by the ordinary method would have taken much longer and would [illegible] been much more costly than by the aerial method. (*The Indian Forester*, V[illegible] No. 8. Dehra Dun, U. P., India, 1924).

244. **Union of South-Africa: Röntgen Rays and the Examina[illegible] of Fruit.** — The Ministry of Agriculture for the Union of South Africa is [illegible]gaged in encouraging the increased exportation of fruit, and in the invest[illegible]tion of methods for ascertaining the presence of damaged fruit which can [illegible]dily be carried out before loading, and will thus obviate the financial los[illegible] curred from carrying unsound fruit on the vessels. The method used for [illegible]tinguishing sound from rotten eggs suggested to W. MALLEY the idea of [illegible]ing the Rontgen rays also for fruit. It is possible in this way to discover [illegible] age due to the larvae of insects not visible externally, or to ascertain when [illegible] fruit is over ripe, even when there is no external indication. The radio[illegible] apparatus would not be within the reach of the individual farmer, but it sh[illegible] and will be possible to construct the necessary plant, on an easily worked m[illegible] for one of the large export businesses. (*Die Umschau*, Year XXVIII, No[illegible] Frankfort-on-Main, 1924).

245. **The Cane Sugar Industry.** — A brief descriptive account is gi[illegible] by G. GARBIN of the history of the industry, the characteristics of the su[illegible] cane and of its cultivation, and the methods of extraction, comparative fig[illegible] being quoted for the different cane sugar producing countries, and inclu[illegible] a diagram of the world production of cane sugar and beet sugar of the pe[illegible] 1850 to 1924. This study presents a certain interest, apart from that [illegible]ing to the comparison between the two different industries which supply [illegible] same product, and thus are in a sense rival. It emphasizes the idea of a [illegible]sible profitable cultivation of sugar cane in Somalia, and suggests its re-introduc[illegible]tion into Sicily as a crop to be grown under modern methods and on a comm[illegible]cial scale on the same land where it was introduced many years ago and [illegible] out of cultivation partly for political reasons and partly owing to degenera[illegible] caused by the presence of local varieties. (GEROLAMO GARBIN. *The Sugar C[illegible] Industry. Importance of the World Production and Possibility of Development [illegible] the Italian Colonies and Sicily*, pp. 18, small 4to, with illustrations and diagra[illegible] Milan and Rome, s. d.).

246. **Jamaica: The "Uba" Sugar Cane.** — The annual report of [illegible] Department of Agriculture states that the year in question (1923) was chi[illegible] remarkable for the campaign against mosaic disease. Uba cane proved [illegible] great service owing to its immunity from this disease; this cane is hardy [illegible] gives a larger tonnage than any other on the island. At the Hope Experim[illegible] Station 35 seedlings have been obtained by crossing Uba with large W[illegible] Indian varieties. (*International Sugar Journal*, Vol. XXVI, No. [illegible] Lond[illegible] 1924).

247. **Netherlands : Catalogue of the Geological and Agrogeological Collections of the Wageningen Higher School af Agriculture.** — This catalogue has been published as part 27, No. 3 of the Mededeelingen van de Landbouwhoogeschool of Wageningen. It consists of 152 pages in 8vo. and the list of the specimens in the collections is accompanied by a bibliography with 55 references. The geological collections are representative of the various regions of Holland (Southern Limburg, Northern Limburg and Brabant, Central, Eastern and Northern Holland, Zuiderzee, Noordzee, Western and South-Western Holland) as well as the colonies (Sumatra, Java, Timor, Borneo, Celebes. Molucca, etc.). The agrogeological collections represent also the various European countries, Africa, Western India and China. (*Catalogus der geologische en agrogeologische Verzamelingen van de landbouwhoogeschool te Wageningen.* Wageningen, 1924).

248. **Porto Rico : New Varieties of Sugar Cane.** — The Annual Report of the Insular Experiment Station for 1923 gives interesting details respecting sugar cane varieties now being tested ; BH 10-12 and Saint Croix 12-4 both give heavy tonnage and high yields of sugar, and both are resistant to drought and more resistant than is usual to mosaic disease. Cane D74 and Badilla are being propagated for distribution. Uba is absolutely immune to mosaic and gumming, but the sucrose content varies greatly with soil and climate. (*Int. Sugar Journal*, XXVI, No. 308. London, 1924).

249. **Sweden : Protection of the European Buffalo.** — An effort to save from extinction the European buffalo, said to be the rarest living mammal in the world, has been begun at Stockholm with the opening of a 100 acre preserve, where these animals will be allowed to live and breed under natural conditions. Out of a total of only fifty-six European buffaloes known to be living at the present time, seven are to be found in Sweden and up to the present this herd has been kept in the open-air museum of Stockholm. (*Science*, Vol. LX, No. 1556, 1924).

250. **Czecoslovakia : Electrification of Country Districts.** — With a view to the promotion of rural electrification, the Council of Agriculture of Prague has recently founded an Experimental Institute with the following objects : (*a*) the study of the relation of electricity to agriculture in general ; (*b*) the study of the development of rural electrification in other countries ; (*c*) the experiments in electrical power etc. at Dražice (where the Central Cooperative Electrical Works are situated) and at the Higher School of Agriculture ; (*d*) the co-ordination of the experimental data in view of the possible application to practice ; (*e*) information to agriculturists on the value of electrification ; (*f*) all work within its competence as Council for electrification. The Czecoslovakian Minister of Agriculture had allocated in the budget of 1924 the sum of 3,000,000 crowns for subsidising the construction of lines for the distribution of the electric power in the communes. (*Publication du Ministère de l'Agriculture de la République Tchécoslovaque*, 1 vol. 8vo., 1924).

Journals and Reviews.

251. **A Proposed Biographical Entomological Dictionary.** — In the *Entomologist* (March 1924) and in the *Entomological News* (May 1924) Professor E. Strand, Director of the Scientific Zoological Institute, University of Riga

(Latvia) has set out his scheme for publishing a dictionary containing the [illegible] biographies of all the entomologists and arachnologists who have, either authors or collectors, contributed to the progress of entomology. All per[illegible] who have done work with insects or spiders are invited to send autobiog[illegible] phical notes to Professor STRAND, 9 Kronvalda bulvars, Riga, Latvia, or [illegible] facilitate the collection of the autobiographies of Americans they may [illegible] be sent to Dr. H. P. K. ÅGERSBORG, Department of Biology, The Ja[illegible] Millikin University, Decatur, Illinois, who will forward them to Prof[illegible] STRAND. (*Science*, N. S., vol. LX, No. 1558, 1924).

252. **A New Review of Biological Science.** — Under the title "*Bi[illegible] Generalis*" is now being published at Vienna and Bratislavia a new period[illegible] containing original articles relating to the three principal divisions of gen[illegible] biology, viz. morphology, physiology and general ecology. It is practica[illegible] international in character and accepts scientific communications in five langu[illegible] ges : French, English, Italian, Russian and German. The Editing Council [illegible] sists of Professor V. RUSICKA, Institute of General Biology, Prague ; Profes[illegible] L. LOHNER, Institute of Physiology, Graz ; Professor R. PEARL, of the *Jo[illegible] Hopkins University*, Baltimore, Maryland, U. S. A. Scientists of high reputat[illegible] in biological studies have promised their collaboration. The publishers [illegible] E. HAIM and Co., Vienna I, Maria Theresienstrasse 10 and Bratislavia, Cze[illegible] slovakian Republic).

253. **New Austrian Timber Review.** — Under the title of *Internat[illegible] nal Holzzeitung* the first number of this review was published in August 1924 [illegible] Vienna (I Passauerplatz 2).

254. **New German Review of Rural Engineering.** — Is published [illegible] Pomerania (Kreisdruckerei Greifenburg) as a monthly periodical, under [illegible] title of *Ratgeber für den Maschinbetrieb in der Landwirtschaft*.

255. **A Specialized Periodical for Chemical Laboratory Practi[illegible]** — This new publication (*Die Laboratoriumspraxis*) was first issued on 1 Janu[illegible] 1925 and will appear twice a month dealing with the whole field of appl[illegible] Chemistry. It is being published, on the initiative of the *Reichsverband [illegible] für Laboratoriumstechnik*, by the *Industriebeamtenverlag*, Berlin, N. W. [illegible] Werftstrasse.

256. **A New Agricultural Review in Guatemala.** — Under the [illegible] "Agricultura" the General Agricultural Association of Guatemala has [illegible] ed the publication of its own official organ which, besides giving a full acco[illegible] of the work of the Association, will contain various articles on scientific ag[illegible] culture, notices of legislation, and of official administrative measures, etc.

257. **"Landbouwkundig Tijdschrif"** is the title of a new [illegible] review, published by the Dutch Farmers' Association in substitution [illegible] the old *Cultura*. The first number contains an article by Professor [illegible] on international agricultural organisation in the future, and one by J. C. [illegible] on researches in fruitgrowing in the United States. In the [illegible] numbers of 1924 there are many other interesting papers and articles.

258. **A New Russian Agricultural Review.** — The first number of [illegible] "*Journal of Experimental Agriculture of South-Western Russia*" has [illegible] published at Saratov. The editing committee is composed as follows : [illegible]

LENSKY, G. K. MEISTER, E. I. PANFLOFF, F. P. SAVARENSKY and N. M. JLAIKOFF.

259. **A New Periodical of Chemistry for Central Europe and the lkans.** — The *Chemische Rundschau für Mitteleuropa und Balkan* has been tablished at Budapest and will serve at the same time as the organ of the Assotion of Hungarian Chemists. Editor-in-chief, Dr. L. v. VASAHEVI. The riodical appears weekly.

rsonal

260. STEPHEN MOULTON BABCOCK, the inventor of the "Babcock Test" for determination of the percentage of fat contained in milk, and formerly ofessor of Agricultural Chemistry at the University of Wisconsin has celeted his eighty-first birthday.

261. JAMES BRITTEN, English botanist and for 40 years editor of the *urnal of Botany*, died on 3 October 1924, at the age of 79.

262. Dr. MAX BÜCHELER, Professor of Agricultural Technology at the Higher ool of Agriculture at Weihenstephen has completed the fortieth year of professional activity. He is well known authority on the theory and techue of distilling, and his process for the preparation of artificial fertilisers means of mineral acids is largely used. At the Higher School of Agriculture Weihenstephen he undertook the direction of the distillery in 1898 and in 8 the direction of the School of Distillation.

263. Professor KARL CORRENS, Director of the "Kaiser Wilhelm Institute Biology" in Berlin-Dahlem, who is especially well known for his researches plant heredity, kept his sixtieth birthday on 19 September 1924.

264. The English Botanist, WILLIAM BOTTING HEMSLEY, custodian of the barium of Kew Gardens, died at the age of 80 on 14 October 1924.

265. The "Darwin" medal of the Royal Society of London has been ferred on Dr. THOMAS HUNT MORGAN professor of Zoology at the University Colombia, in special recognition of his research work on the laws of heredity.

266. An honorary decree has been conferred on Dr. HEINRICH LUMBE, nder of the famous Bird Protection Park at Aussig, by the University of nna.

267. Professor JULIUS STOKLASA, well known for his valuable research work he field of agricultural chemistry and biochemistry, Professor of the Higher hnical School at Prague, Director of the Czecoslovakian Experiment tion for Crop Production, and First Acting President of the Czecoslovakian titute of Agriculture, has celebrated the fortieth anniversary of his scientific er.

ALFREDO RUGGERI, *gerente responsabile.*

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CURRENT NOTICES.

NOTE. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review.*

The Editors notes are marked (*Ed.*); the letter *R.* indicates the references to the foregoing issues (Monthly and Quarterly) of the International Review.

ORIGINAL ARTICLES

RADIOACTIVITY OF THE ERUPTIVE GASES OF MT. VESUVIUS AND OTHER SOLFATARA VOLCANOES, AND THEIR INFLUENCE ON THE DEVELOPMENT OF BACTERIA AND OF HIGHER VEGETATION.

It would be of great interest to ascertain whether the gases actually emitted by the volcano are radioactive and to what degree. For this purpose experiments were made with respect to the electric conductibility of gases emanating not only from Vesuvius itself, but also from the Campania.

The electric conductibility of these gases depends on their radioactive elements. The results obtained are of great importance, not only as regards physics, but in respect to chemistry, geology, and above all, physiology. The tests were carried out on Mt. Vesuvius, at Pozzuoli, at Solfatara and at Posillipo, and confirm the accuracy of previous results obtained on Mt. Vesuvius and on the Campania. Four months before our visit a new crater called the Forum Vulcani burst open at Solfatara; the fumeroles reach a temperature of 500-600°C. The various gases emitted by this new crater contain besides steam, hydrogen compounds, more especially ammonia and sulphuretted hydrogen. These compounds have been found to be radioactive.

By means of the GERDIEN apparatus the electric conductibility was ascertained of the gases emitted by Mt. Vesuvius and the newly formed crater, Forum Vulcani. The electric conductibility of gases directly given out by Mt. Vesuvius, could not be studied, because new formations made its crater both inaccessible and dangerous.

These gases were therefore tested when diluted by contact w air and the electric conductibility of the atmosphere was found be as high as $4.8.10^{-4}$ U.E.S.

The conductibility of gases at their actual exit from the v cano is undoubtedly much greater than shown by our tests. Atm spheric electric conductibility in close proximity to the crater rea es $4.5.10^{-4}$ U.E.S. The atmosphere below the volcano itself sho an electric conductibility of $1.2.10^{-4}$ U.E.S. and both at Pozzu and at Posillipo an atmospheric electric conductibility of 2.4.10 and up to $2.6.10^{-4}$ U.E.S. was recorded.

It should moreover be noted that there are present everywhe at Pozzuoli and at Posillipo, fumeroles emitting radioactive gase At Naples, the atmospheric electric conductibility was found to $0.9.10^{-4}$ U.E.S.

These are the first practical studies made of atmospheric electr conductibility produced by radioactivity on Mt. Vesuvius. Conduc ibility in this instance is twice as strong as that of the atmosphere a Jachymov (Joachimsthal), near the radium factory.

The atmospheric electric conductibility at Jachymov was 2.4.10 U.E.S. ; at Karlovy Vary (Karlsbad), $1.0.10^{-4}$, U.E.S., and at Rom $0.7.10^{-4}$. Gases exhaled by the crater Forum Vulcani at Solfatar show an electric conductibility of $2.8.10^{-4}$ U.E.S. and as high a $3.6.10^{-4}$ U.E.S.

The same degree of conductibility has also been found in th case of gases that have been diluted by contact with air. The figure stated are an average resulting from very numerous tests.

Tests were also carried out over the sea near Messina, at Patra in Greece, at Ragusa and at Trieste ; electric conductibility in thes cases reached 0.6 to $1.2.10^{-4}$ U.E.S. In all these tests allowance was made for atmospheric humidity and temperature.

Similar tests were made at Paris, above and below the Eiffel Tower. Atmospheric electric conductibility rose to : $0.4.10^{-4}$ U.E.S below, and $0.8.10^{-4}$ U.E.S. above the Tower.

It was of the greatest importance to ascertain the condition of the atmosphere above the potash beds of Mulhouse, as potassium is radioactive and gives out Beta rays. The atmospheric electric conductibility at Mulhouse was found to be $0.8\text{-}1.0.10^{-4}$ U.E.S. whereas underground in the salt mines ($NaCl$) it was $0.4.10^{-4}$ U.E.S. and in the layers of potassium salts (KCl) conductibility rose to $2.8.10^{-4}$ U.E.S. In the wooden sheds of the factory where the potash salts

ıy heaped up it was $3.6.10^{-4}$ U.E.S. and in the empty wooden sheds, .0.10^{-4} U.E.S.

The atmospheric electric conductibility in the potash mines is ıus as high as that of Mt. Vesuvius.

Owing to their content of radioactivity, the gases emitted from 'esuvius possess extraordinary physiological influence. Sulphurous :id formed by the oxydation of sulphuretted hydrogen is immediate- transformed into sulphuric acid and can therefore have no ıjurious influence on vegetation. The injurious gases that estroy all vegetation on the top of Mt. Vesuvius are fluorine ɔmpounds.

Atmospheric radioactivity as well as radioactivity of the soil ıvours the development of leguminous plants especially of *Spartium ınceum* and *Robinia pseudoacacia*, which are amongst the pioneers f vegetation. Nitrogen-fixing bacteria especially thrive on radium nanations. Alpha rays favour de-nitrification by bacteria, and crease their respiration, provided there is an excess of oxygen pre- :nt. The process of de-nitrification by nitrogen-fixing bacteria is genetic connexion with the power of nitrogen-fixation in the air. hus, it is noted that nitrogen-fixing bacteria are extensively found, ɔt only on the lower slopes of Mt. Vesuvius, but also in the soils the Campania. These soils are characterized by very high radio- :tivity. These investigations show that soils covered by a luxuriant :getation have a radium content of $3\text{-}5.10^{-12}$ g. pro. g. Throughout ıe Campania the productive capacity of plants is a striking feature hile fruit is gathered three times a year.

The hydrogen-ion content of these soils varied between pH 6.8 ıd 7.5. These soils are therefore neutral.

In the South, photosynthetic processes develop more rapidly ıder the influence of a greater intensity of sunlight, of heat, and of ıe action of nutritive mineral matter in the soil. Rays emanating om radioactive bodies, more especially the Beta and Gamma rays, ıe influence of which acts on the leaves, have an entirely different fect than in our colder countries. Carbo-hydrate production is intense that oxydation due to Alpha rays from radioactive bodies :oduces no diminution in it.

The radiant energy of the sun, which in the chlorophyll cells ·ings about the synthesis of organic matter by the aid of inorganic ıbstances, is related to the Beta rays emitted by potassium. hese Beta rays, penetrate the entire chlorophyll cell and certainly

react on the process of photosynthesis and on the production of or substances by the assimilation of carbonic acid.

These experiments show that the endothermic fundamental cess that brings about photosynthetic assimilation of carbonic is merely the decomposition of bicarbonate of potassium unde action of light and radioactivity, with the production of formic oxygen and carbonate of potassium as well as the decompositi formic acid and the production of formaldehyde and oxygen.

This photosynthetic process must be influenced by the r activity of potassium.

From the numerous experiments carried out during the last t years, it is concluded that photosynthesis in the chlorophyll c assisted by Beta and Gamma rays emitted from various radioa substances.

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THE BENEFICIAL AND INJURIOUS EFFECTS OF SHORT-WAVE RAYS IN NATURE.

Observations, carried on over a period of 30 years, with regard) the action of different forms of energy on the germination capacity ' seeds repeatedly brought to light whole series of, in some instances, ery significant cases of disease in 1300 kinds of seed. These diseases, used in some cases by too strong concentrations of energy, were ten difficult to determine, because the symptoms were frequently ot uniform. In particular, the author did not for a long time re- gnise the nature of the serious injuries constantly occurring when eds germinated in the dark were exposed to the light, because side side with quite characteristic individuals with closely joined coty- dons, all kinds of stunted forms appeared, which alternatively ere combined with more than 50 % of individuals destroyed before rmination. The author has described in detail these effects of diation in his publication "Frost und Licht", 1912-20. The eds of *Amorpha*, which are particularly well suited for the solution the problem, provided the opportunity for a series of tests, the culiar nature of their small husks making possible an application six different forms of energy. The tests could be carried out 1 the seeds when still covered by the husks and rendered immune an abundance of essential oil both within the husks and on the idermis of the seeds themselves, also on the seeds separated from e husks, surrounded with a layer of resin oil, and finally on the seeds hen released from this layer after four hours' treatment with alcohol. 1 this way it was possible under the influence of light and also shutting off light, finally so to check the respiration in the light, conditions of its highest stage of freedom (1) (alcohol test), that e limit of the respiration beneficial to the progress of seed ger- ination was passed, and henceforth in contradistinction to the results

1) It may be noted in this connection that, according to Verschaffelt, an increased edom of respiration and further swelling can be brought about at pleasure by longer ohol treatment. The oil is removed in a very short time.

of the two first parallel series of tests, a simple germination i[illegible] dark was obtained. Here in the last series of tests a 100 % [illegible]mination in the dark was already reached after 26 days, whereas [illegible] respiration is impeded by the husks germination stops earlier at [illegible] and the small quantity of light passing through the husks will [illegible]ably take a whole year (as in other cases) to have any eff[illegible] bringing about germination to the same extent. The short [illegible] which is given later, shows clearly that, at the medium rate of [illegible]ration (hulled seeds only), a similar reading results as in the [illegible] of almost all seeds of wild leguminous plants, showing in fact [illegible] germination in the light during the course of a year const[illegible] proves slightly better than in the dark, so much so indeed th[illegible] extreme cases certain of the seeds remaining in the dark germ[illegible] many years later than those to which the light had access. In [illegible] leguminous plants growing on sandy soils, such as *Spartium jun[illegible]* and *Sarothamnus scoparium* (Broom), germination in the dar[illegible] much more strongly suppressed, so that in a number of years [illegible] ⅓-½ of the seeds arrive at germination. At an earlier sta[illegible] was clearly proved in the case of the large seeds of *Calycanthus* [illegible]*cox* that the hulled seeds germinated in the dark in one month [illegible] 100 %, whereas in the light there was only 30 % of moder[illegible] healthy germination, while the remainder, in addition to 50 % [illegible]ed, showed the types mentioned with close pressed cotyledon[illegible] all stages up to the diseased stunted forms. On the other hand [illegible] the protection of the thick husk it was only after 18 months that [illegible] effect of the small amount of light that penetrated the seed c[illegible] became noticeable, so that the germination which then stoo[illegible] 0 : 18 % (D) in the next period in the dark reached 20 % and [illegible] arrested there, while only after that in the following months, in co[illegible]quence of the reduced penetration of the rays, did the germina[illegible] proceed steadily and normally (compare *Amorpha*).

Later investigations showed, apart from many other exce[illegible] examples for our subject, that in the case of *Prunus Padus* (b[illegible] cherry) which germinates in the dark and below freezing poi[illegible] addition to a normal germination in the dark and below free[illegible] point complete in 12 months, there were after the lapse of that [illegible] only 4 % in the light at a temperature of 20°C. of instances of [illegible] normal germination, while after 2 ¾ years at 20°C. many exa[illegible] were noted with close pressed cotyledons, besides over [illegible] % wh[illegible] died before attaining any real development. Similar record[illegible]

injury (50 % killed) were established after some years of observation as due to the influence of light at a temperature below freezing.

In other instances again, on elimination of the factor of frost, development at 20°C. is extraordinarily slow, but at the same time, owing to the protecting seedcases, quite normal. A good example of such instances is supplied by the large black seeds of the peony (*Paeonia*) with which the author has been carrying on this experiment for 14 years. With these seeds the above mentioned reversal of behaviour, due to the penetration of a very small quantity of light (1), only came about in ten years, while arrest of germination in the dark was noted in the case of 42 % in 6 years, followed by a slower progress up to 67 % in 14 years. As the ratio of the development is important for our enquiry, the figures for the separate years may be given. The figures in the following statement may be taken as correct for over 800 different kinds of land plants.

In cases where germination was originally simple germination in the dark (cf. *Amorpha*, *Calycanthus*, etc.), in the first year the proportion of light to dark germination was, in the first half year, 0 : 11, after one year 4 : 22, after 2 years 8 : 37, after 3, 10 : 38; after 4, 12 : 40; after 6, 31 : 42; after 8, 38 : 42; after 10, 46 : 42; after 11, 54; after 12, 58; after 13, 64; after 14, 67. Darkness and freezing together bring about the full germination in this instance usually after several years, and even at a temperature of 20°C. no deterioration took place, owing to the protective seedcases (in contradistinction to the case of the bird-cherry). The plants develop quite normally and the author has in his garden healthy, regularly flowering, peonies of many year's growth.

The quantity of energy that penetrates the seedcases is so small that paper sensitive to daylight is not darkened even in long periods (*Daphne* tests). It remains to determine in each case the nature of

(1) It is highly probable, from the colour and formation of the seed case in the examples mentioned above, that the light which has gradually filtered through the protecting husk over long periods of time contains a preponderance of red and ultra-red rays, while in other instances much shorter wave lengths up to the ultra-violet may be present.

Special note should also be made of the simple germination in the dark of *Passiflora* (black ribbed seedcases) which in the 13th year remains at 37 out of 96: the deterioration of the seeds of *Nigella* which become tolerant of light at 20°C (also *Allium*, *Porrum*, etc.); also the injury from frost and light occurring with the seeds of *Oenothera*, *Trollius*, *Prunus spinosa*, *Parietaria*, *Cucubalus Vaccaria* (serious injury), *Cerinthe*, all of which seeds are shaded, *i. e.* contained within thick walled seedcases; also the seeds of *Myricaria*, *Peplis*, *Sedum acre*, *Limosella*, numerous kinds of *Veronica* (especially *V. officinalis* and *V. peregrina*), all of which are exposed to the light.

these rays. The colour table given in "Frost und Licht", 1[...] p. 144, should also be compared, showing the action of colo[ured] light on matt photographic daylight-sensitive paper, after 15 [...] after 90 minutes.

Of late, the investigation which has been already described [...] carried out on *Amorpha*, and was made possible by the special cha[rac]teristics of its seeds, has acquired much significance, as it has suppl[ied,] in agreement with earlier experiments of which only this brief m[en]tion is possible here, a long-desired explanation relative to the ext[ent] of the effect of the rays. The following short table makes it p[os]sible to form an idea of such effects as have already been describ[ed] as compared with other effects determined in shorter periods.

Germination of Amorpha fruticosa (constant temperature of 20[...]

Number of days elapsed		1	4	5	6	9	10	11	12	13	15	16	17	18	19	22	23	24	25	26	33	
		Percentage germinated																				
Light	a)	—	—	—	—	—	—	—	2	—	4	—	—	7	11	14	—	—	—	—	—	Further germ[illegible] in the [illegible] years.
	b)	—	—	—	—	2	3	13	15	22	40	52	60	63	68	73	74	75	—	—	77	
	c)	—	—	—	—	3	7	8	11	16	35	44	55	50	68	70	80	81	83	84	87	
Dark	a)	—	—	—	1	4	—	6	8	—	10	11	—	—	—	12	—	—	—	—	—	Slow progress [illegible]
	b)	1	—	—	—	2	—	8	14	20	37	46	55	60	67	70	73	74	—	—	76	
	c)	-	4	6	7	8	11	12	16	25	48	57	68	73	84	93	94	95	96	100	—	

(*a*) Seed in husk after 40 days; 17 : 12.
(*b*) Hulled seed with a natural layer of resin oil.
(*c*) Oil removed by alcohol (96 %) 4 hours steeping etc.

An equable temperature of 20°C. in the case of germinating seed is always to be [un]derstood in articles by the author, if no other temperature is stated.

A clear conception of the rapidity of the action of the rays [...] supplied by the recent investigations of E. LEHMANN and RAO LA[K]SCHMANA as to the validity of the law of production in the case [of] germination in light of *Lythrum Salicaria*. The authors with [...] illumination of 200 candle-power for 5 minutes, and with one of 5[...] candle-power for 15 minutes and a third of 5 candle-power for thr[ee] hours, established almost the same percentage of germination ([an] average of 46 %) in each case, as the total amount or effective ra[...]

ation was during these three periods practically the same. The llowing were the results:

Illumination	Period of exposure	Light Power c. p. × sec.	Percentage of germination
5 c. p.	3 hours	54,000	45.25
50 »	15 minutes	45,000	49.72
200 »	5 minutes	60,000	43.00

These highly valuable and precise results provide a sound basis r the comprehension of the extremely slow progress of germination ıder a still smaller number of rays.

Reference will now be made to the experiments on short-wave ght of the oculist SCHANZ (1), whose premature death is much gretted. SCHANZ showed that eosin solutions, introduced into the rculatory system of the plant, bring about the same striking developents which are known to be typical of alpine plants with stuntl stem branchings. If this fact as established by SCHANZ be comared with the recent results on seed germination, a clearer idea will e obtained as to many of the remarkable processes of retardation the growth of young plants as described in this article. The reason hy the real effect in the case of the short-stemmed individuals only radually became evident to the author may be explained, on the ıe hand, by the large number of tests undertaken and, on the other, y the fact that only individual forms of development were suitable r recognizing the now well understood action of the short-wave ght. SCHANZ's last published work on the subject is to be found gether with a summary of his other publications in the treatise Erscheinung der optischen Sensibilation bei den Pflanzen" in ıe report of the German Botanical Society (Deutsche Botan. Ges.), 923. No. 25, pp. 167-170. SCHANZ proved that eosin introduced ıto the body of an animal (by feeding eosin barley) (1), and into ıe human body, produces symptoms similar to those observed under the designation of 'glacier burn'. If in conjunction with this ell recognised photodynamic effect of eosin, established as it is y numerous biological tests, there is considered the similar effect f quinine, which also acts photodynamically, a further, and no onger very suprising point of view is reached.

(1) Also to the works of E. MERKER.

(2) With regard to eosin-fed pigs and eosin-fed mice, the reader is referred to the footote which follows on the feeds which only take effect photodynamically on white animals, r in a strong light, or in the combination of both conditions.

It is a matter of common knowledge, and has been estab[illegible] beyond doubt by experience, that cattle which have been e[illegible] for a long time to the intense rays of the sun readily contract [illegible] nettle-rash if there is too sudden a change of temperature on [illegible]ing to dark and chilly sheds. Similarly nettle-rash may be in[illegible] in a more or less severe form according to the particular case [illegible]tain feeds (1), the photodynamic action of which is still [illegible] ascertained. Conditions however are less clear as regards the h[illegible] subject. Besides quinine, certain foods such as strawbe[illegible] crayfish, etc., and also intense nervous strain may induce nettle[illegible] in varying degrees of severity, including that of nettle-rash [illegible] The author has himself for years past had an opportunity of o[illegible]ing in specially favourable circumstances that, in a case of nettle[illegible] originally probably brought on by change of climate, the rash w[illegible] apparently had nearly disappeared kept coming out again at [illegible]ger or shorter intervals, especially under conditions of great ner[illegible] strain. It seems to the author therefore, in the light of what [illegible] been said, essential to take careful account, in order to find the [illegible] explanation of this hitherto mysterious disease, of these rel[illegible] phenomena, as he is convinced that herein may lie the key to a be[illegible] understanding of this very unpleasant, though not usually dange[illegible] ailment. A suitable form of treatment for the case of too su[illegible] introduction into a climate poor in radiation would no doubt [illegible] comparatively easily found, thanks to the success of the m[illegible] treatment by light.

The author has welcomed the opportunity of submitting, a[illegible] years of work, this brief review of a subject which originally lay out[illegible] the scope of his studies, since it is impossible to ignore the quest[illegible] how far the action of short wave light is present in other biolog[illegible] processes, and indeed even in apparently lifeless matter, in st[illegible] and minerals of all kinds. The decomposition of many artific[illegible] formed chemical compounds by short wave light is already sufficie[illegible] well known.

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(1) The course taken by the buckwheat rash in the case of white sheep, with [illegible] effect at times, may be [illegible]. The rash does not appear [illegible] Also the influence of light on the after effects of [illegible]

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CULTIVATION OF WHEAT AND OTHER CEREALS IN ROUMANIA.

WHEAT.

The total area under cereals in Roumania is 2,690,341 hectares. The average yield per hectare varies greatly from one year to another owing to the very variable growth conditions, as well as to the tillage, which is generally carried out carelessly and in an unsatisfactory manner. Roumanian wheat nevertheless being of superior quality, is in great demand on the principal corn markets of Europe.

The climate of Roumania varies from year to year and according to the district, and this causes a marked difference in the quality and quantity of the yield. Similarly, the weight of a hectolitre of wheat varies greatly according to the year and district. The following table containing data relating to precipitation, will enable an opinion to be formed as to the variability of the Roumanian climate :

Year	Precipitation mm.
1920	548
1921	507
1922	677
1923	544

The heat of the sun's rays is generally intense, which prevents the wheat-stalk from attaining its normal development.

Varieties. — The following species of wheat are generally grown in Roumania :

(1) *Triticum sativum* Lam. (soft wheat), including the sub-species :

(*a*) *Triticum sativum vulgare*
(*b*) " " *durum*
(*c*) " " *spelta*
(*d*) " " *dicoccum.*

PLATE XXIV.

FIG. 63. — Wheat, improved white Roumanian.

PLATE XXV.

The majority of the types grown in Roumania belong to the sub species *Triticum vulgare*, and include:

(1) *Triticum vulgare lutescens*: Ulka wheat,
(2) " " *miltura*: Ghirka wheat,
(3) " " *albo-rubrum*: Sandomir wheat,
(4) *Triticum vulgare erythrospermum*: white Roumanian wheat, Banat wheat, Baltatzel wheat.,
(5) *Triticum vulgare ferrugineum*: Roumanian red wheat.

Of the sub-species *Triticum durum* (hard wheat), the following have up to the present been identified in Roumania:

Triticum durum hordeiforme: Arnaoute wheat,
" " *leucomelan*: Turkish white wheat.

Of all these varieties the Roumanian white wheat and the Banat are the most extensively grown.

The Roumanian white wheat (Plate XXIV, Fig. 63) has a well-developed fasciculated root; the stalk is 1-1.60 m. long, with 4, 5 an sometimes 6 nodes.

The stalk is thinner and less resistant to bending than that of other species.

The leaves are 5 in number, of an average width of 1.08 cm., and much thinner than those of foreign varieties. The average length of the limb is 23 cm. In autumn the leaves are blueish-green in colour.

The ear is white, tapering towards the top, with narrow insertion. At its base there are always 2 to 3 sterile spikelets. Generally the glumes do not closely envelop the grain, so that the latter is liable to fall.

The grain is dark red, flinty in section, average length 7 mm., and 3 mm. wide; the envelope is thin as compared with that of foreign varieties. The weight of the hl. varies from 75-80 kg., that of 1000 grains from 28-37 gms. The Roumanian white wheat is a hardy species, well adapted to local conditions, early and very resistant to bad weather.

The Banat wheat has a strong yellowish-red stalk. The leaves are few in number. The ear is reddish-brown, awned, small, not thick, and about 15 cm. long.

The grain is reddish-brown, sometimes with yellowish red shades, flinty section, rich in protein and of superior quality.

Like the Roumanian white wheat, the Banat wheat is an ea variety and resistant to winter weather.

The Roumanian red wheat (Plate XXV, Fig. 64) has a red, aw ear and a thick, stiff stalk. The grain is larger than that of ot varieties and lighter in colour and of floury texture, sometir slightly flinty. The weight of a hectolitre is less than that of wh wheat. Red wheat is less extensively grown than white.

Ghirka wheat has a short thick, very stiff stem. The ear is r of narrow insertion, with awned spikelets. The grain is red, sma flinty and of superior quality.

Ghirka wheat is generally grown as a spring crop.

Sandomir wheat (Plate XXVI, Fig. 65) has a yellowish-red stal thin, but fairly stiff. The ear is light red, of narrow insertion, ta ering at the top, and with a short awn. The grain is yellowis white, small, oval, and of floury texture.

Sandomir wheat is very early, and resistant to bad weather a rust. It is mostly grown in Bessarabia as a spring crop.

Arnaoute wheat (Plate XXVII, Fig. 66) has a long, reddis yellow stalk. The ears, blueish-green when young, change to ligl red on maturity, and are covered with a blueish deposit. The e is thick and square in section. The grain, is light yellow, long an pointed, flinty, thin tegument, and of very good quality.

Arnaoute wheat is in great demand on the corn markets for t manufacture of food pastes. It is grown as a spring crop, especiall in Bessarabia and Dobruja.

Turkish white wheat (Plate XXVIII, Fig. 67) has a strong, lon stiff stalk, a short, reddish ear square in section, larger and dens than that of Arnaoute wheat. The awns are very long and har the lower part being black and the upper part yellow. The grai is large, long, pointed, flinty, very rich in protein, of very good qualit and in great demand for the manufacture of flour pastes.

Ulka white wheat (Plate XXIX, Fig. 68) has a yellowish-whit thin, fragile stalk. The ear is long, of narrow insertion, awnless, a white. The grain is long and reddish-yellow, flinty, slightly concav and with a small tuft of white hairs.

Wheat-growing. When grown on a large scale in Rouman wheat is sown after maize; on less extensive areas it comes aft peas and beans, or rape. In Bessarabia and Dobruja, where whea is sometimes sown after sunflowers or after fallowing, it is sometim grown several years in succession on the same field.

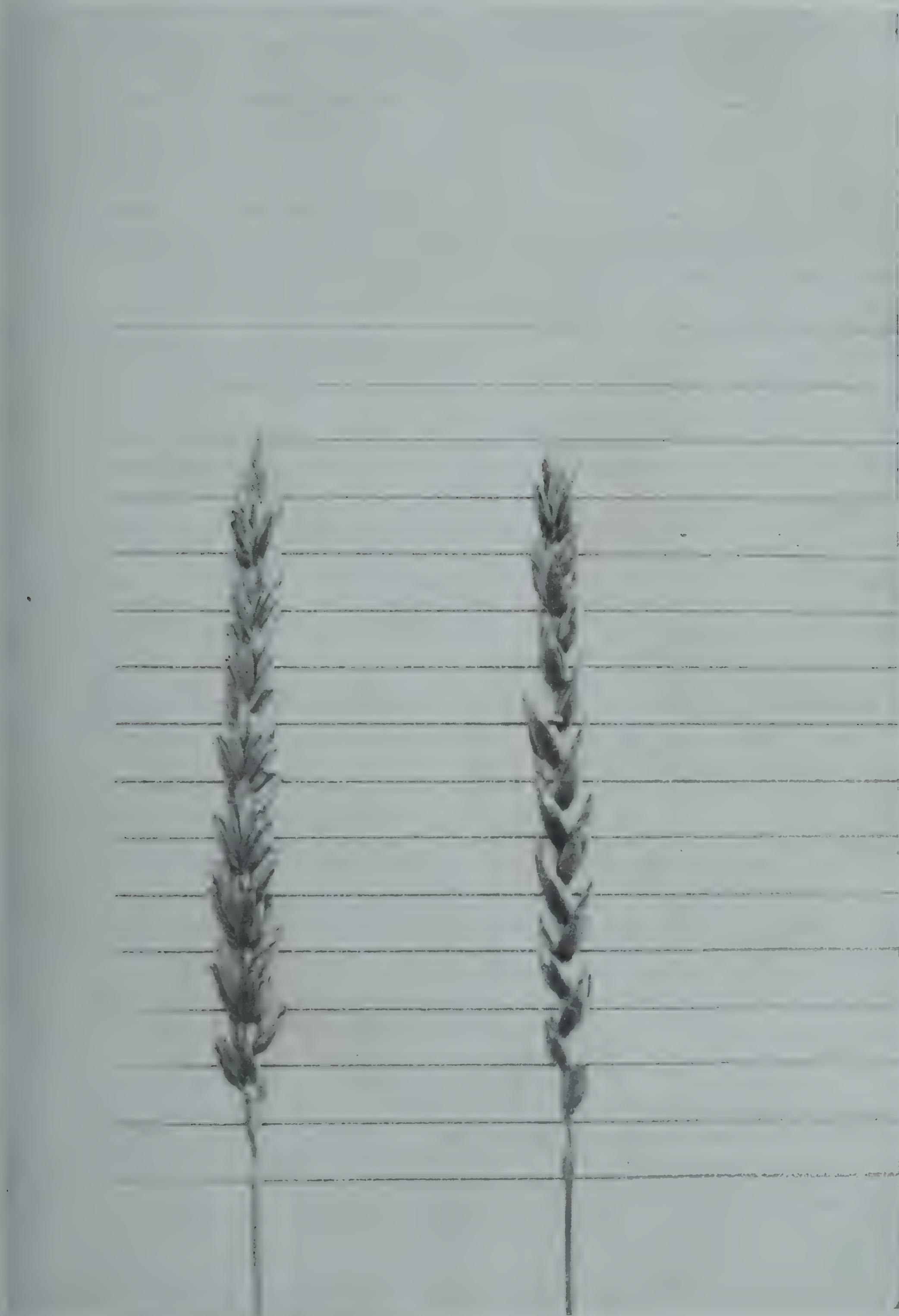

FIG. 65. — Wheat, Sandomir.

FIG. 66. — Wheat, Arnaoute

FIG. 67. — Wheat, white Turkish.

PLATE XXIX.

FIG. 68. — Wheat, white Ulka (winter).

When, owing to the advanced season, wheat is grown after maize, soil is only tilled once, i. e., after the maize has been cut. If wheat own after a leguminous crop, rape or fallowing, the soil is ploughed e: once, more deeply, immediately after cropping, the second time re sowing. The latter is done from the beginning of September l winter commences. Drills are used to a large extent, but the ll farmers have mostly continued the broadcasting system. Spring at is sown immediately after the thaw sets in.

Before sowing, the soil is harrowed with an iron harrow, and after ing, with a "bramble" harrow, an implement peculiar to Rouian agriculture.

Sometimes wheat is sown broadcast in fields of maize before latter is cut; the soil is than harrowed once only, after the maize been harvested. Wheat is sometimes sown broadcast before ghing, which takes place immediately after sowing.

The seed is generally treated with a solution of copper sulphate protection against fungoid diseases, which are prevalent in Rouia, especially *Tilletia tritici*.

The quantity of seed used for sowing in drills varies from 160-180 and for broadcasting, from 180-200 kg. per ha., according to season in which it is sown.

Under a good system of farming, the soil is harrowed in il.

The wheat is harvested between 20 June and 25 July, according e district. The scythe or sickle is used; on large farms, however, ordinary reaper, or the reaper-binder isemployed. Wheat reaped and or by the reaper, and not bound, is tied into sheaves after ng in the air for some hours, and placed in stacks, or cross-, on the field. The shape of the ricks varies according to the dis-. Threshing is done with threshing-machines driven by steam-nes, animal power, or by hand. In Bessarabia, Dobruja, and e parts of Moldavia, threshing is carried out by animals trampling wheat, which is spread out on a threshing-floor adapted this purpose. In these districts stone rollers are sometimes l, being passed over the wheat spread out on the threshing .

The wheat yield in Roumania is generally small and very var- owing to the uncertainty of the climate, and especially he frequent droughts. The quality and the weight of the olitre also greatly vary from one year to another. The

average yield per hectare for the agricultural years 192[illegible] varied as follows :

Year	Average yield per hectare	Weight per hectolitre
1920	10.9	74.8
1921	11.1	75.6
1922	12.3	76.6
1923	12.5	77.2

The diminished yield of recent years is mostly due to dr[illegible] in autumn, germination being delayed until January and Feb[illegible] under the melting snow.

Improvements. Wheat is one of the principal exports of Ro[illegible] nia. It was natural therefore that efforts should have been [illegible] to improve the crop, both as regards quality and quantity. A[illegible] tion has been given to increased yield and resistance to lodging [illegible] to cryptogamic diseases, especially rust.

The work done by CIPAIANU, SANDU, ALDEA, IONESCU[illegible] SESTI, ASBIOVICI, and MUNTEANU has been mostly in conne[illegible] with the selection of different pure species of Roumanian w[illegible] the crossing of various pure Roumanian with improved Rouma[illegible] and with foreign species ; among the latter the following have [illegible] selected : Mette's Square Head, Strube's Square Head and ce[illegible] Swedish types. Among the various Roumanian types the follo[illegible] have been chosen : Roumanian white wheat and Banat wheat [illegible] results obtained are considered to be very important from bo[illegible] scientific and practical point of view. The comparative gr[illegible] test of the different species will enable a selection to be made o[illegible] most resistant and productive.

MAIZE.

Maize is the principal food of the rural population, and is the[illegible] cultivated over a much larger area than wheat. In 1922-192[illegible] area under maize was 3.404.492 ha., and yielded a total of 39.[illegible] hl., an average yield of 15.1 hl. per ha. According to the stat[illegible] maize occupies the largest area under cereals. The following [illegible] shows the area and yield of the Old Kingdom before the war, and [illegible] of Great Roumania.

Old Kingdom.

Year	Thousands of hectares	Total yield in thousands of hectolitres	Hectolitres per hectare
1912	2079	31,621	17.6
1913	2147	40,407	18.8
1914	2066	36,139	17.5
1915	2107	70,452	14.5
1920	1888	35,872	19.0
1921	1861	21,221	11.4
1922	1977	22,539	11.5
1923	1966	37,154	18.9

Great Roumania.

1920	3295	61,512	18.1
1921	3443	37,472	10.9
1922	3403	39,305	11.5
1923	3404	57,409	16.6

Varieties. Amongst the varieties of maize grown in Roumania .re the following:

Horse-tooth maize (Plate XXX, Fig. 69) is grown mostly in Wal-ıchia, in the plain regions; it matures rather late, the growth period veraging 136 days. The stem .s rather tall, attaining a height of as ıuch as 1.70 m.-2 m.; it is of average thickness, and bears 1-3 ears erminating in a point. The ear is short and covered with grain to ıe top, of cylindrical shape, and from 14.2-16.9 cm. in length. The roportion of grain is fairly large: 100 kg. of ears yielded 82-87 % f grain. The grain is large, light yellow and of floury structure. he weight per hectolitre is comparatively low, varying from 71-75 g. There are also earlier species of "horse-tooth" grown in small uantities in the plain of Wallachia, some having a red, and others white cob.

Roumanian maize (Plate XXX, Fig. 70) is only grown in the istrict of Prahova, Dambovita, Muscel, Ilfovet and Buzau. The rowth period is 150 days. The plant grows to a height of 1.80 to 50 m.; the ears are short, thick and generally bear 12 rows of seed; ıe cob is thicker than that of the "Horse-tooth" variety: 100 kg. ears contains 18-20 % of cob; the grain is fairly large, yellow, and ›ury.

Hanganesc maize (Plate XXXI, Fig. 71) is grown chiefly in the ountainous regions of Moldavia, by large growers. It is one of the ost early varieties, the growth period being 120-130 days. The stalk

is short, averaging 120 cm., and thin. The ears are short and th
with 14-18 rows of seeds. The percentage of the cob is higher t
that of the other varieties, being as much as 20 %. The light-colo
seeds weigh 77-87 kg. per hl. The yield is large compared
that of other varieties, averaging 30 hl. per ha.

Scorumnic maize (Plate XXXI, Fig. 72) is grown only in
mountainous regions of Wallachia; the growth period averages
141 days. The stem is rather tall, attaining 2-2.5 m.; there are ge
rally one to two ears, pointed, of an average length of 18-21 cm., w
8 rows of seeds grouped two by two with spaces between. Owin
these peculiarities the percentage of seeds is smaller than that
the other varieties, varying between 71 and 82 %. The cob is w
and bears 12-18 rows of seeds, which are dark yellow, wide and la
The average weight of a hectolitre is 74-75 kg. The yield per hect
varies greatly according to climatic conditions, the average be
2500-2800 kg. per hectare.

Cinquantine maize is only grown in Moldavia by the large f
mers. It is an early variety, the growth period being 130-140 da
The stem is not tall, attaining 130-140 cm., and is thin. The e
are cylindrical, rather conical, and only 9-16 cm. in length. The c
are white and thin, so that their percentage is below that of
other varieties. The seeds are small, hard, dense, pointed, li
yellow or golden yellow, and 8-9 cm. long. This type of maize
longs to the small-seed varieties. The weight of a hectolitre is
88 kg., which is higher than that of the other varieties. As rega
its food value, this type may be classed among the best varieties.

Pignoletto maize (Plate XXXII, Fig. 73) is grown only in cert
districts of Wallachia, especially those of Braila, R. Sarat, Buzau,
in Moldavia. It is early, the growth period lasting 130-140 days.
thin stem reaches an average height of 150-180 cm. and bears
ears. The latter are thin, 11 to 13 cm. long, and tapering towa
the top. The cob is white and conical. The seeds are set in strai
rows, which number from 12-26; the seeds are dense and flinty;
lower ones form four horizontal rows with more pointed tops;
seeds are 8.3-9 mm. long, 5.3-7 mm. wide, and of an orange col
The hectolitre weighs 80 kg. The yield per hectare is large, avera
3000 kg.

Orange-coloured maize or *red maize* (Plate XXXII, Fig. 74)
classed among the semi-late varieties, the growth period lasting
145 days. The thin stem generally bears one ear only, rarely tw

FIG. 69. — Maize, horse-tooth, after J. ENESCU.

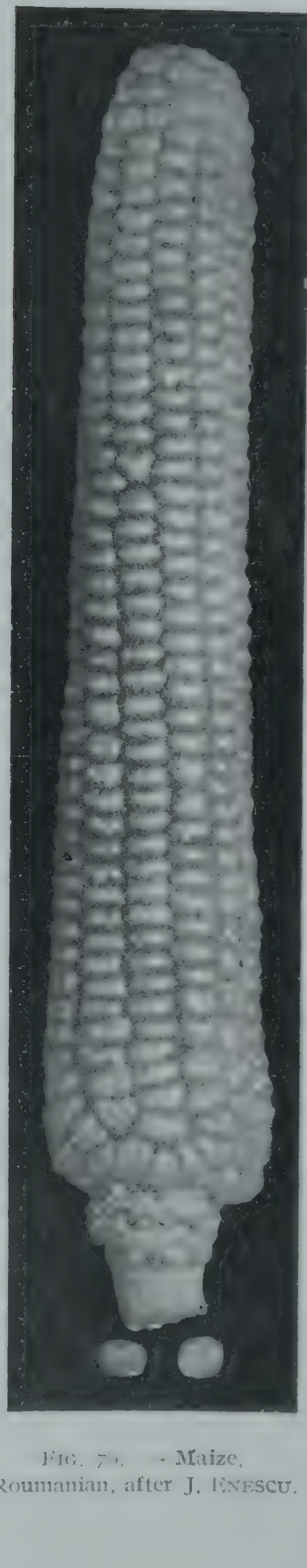

FIG. 70. — Maize, Roumanian, after J. ENESCU.

PLATE XXXI.

FIG. 71. — Maize, hangarese, after J. ENESCU.

FIG. 72. — Maize, [illegible], after J. ENESCU.

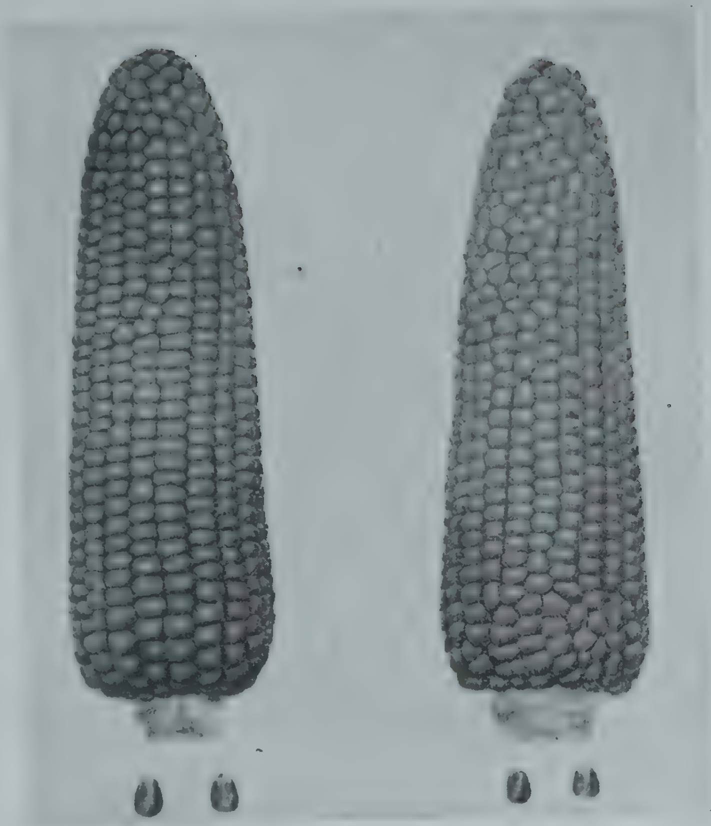

FIG. 73. — Maize, Pignoletto, after J. ENESCU.

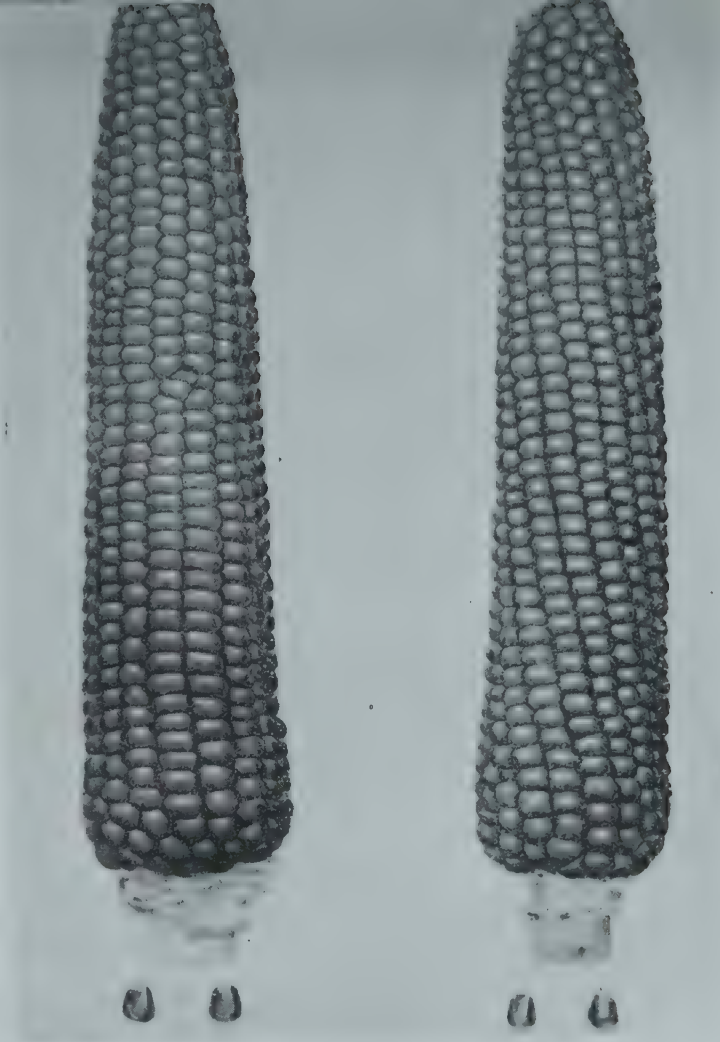

FIG. 74. — Red maize, after J. ENESCU.

PLATE XXXIII.

FIG. 75. — Barley, Hanna two-rowed

The ears are 14-16 cm. long, with pointed tops, and have 12 rows of seeds. The percentage of cob is larger than that of the Pignoletto, averaging 20 %. The seeds are orange-red, wide, and flinty. The hl. weighs 79-80 kg.

Banat maize is grown mostly in the region from which it takes its name. It is a semi-late variety with a tall stem, 2-2.5 m. The ear, almost cylindrical, is 20-24 cm. long, with 12-14 straight, dense rows of seeds. The average of cob is rather high, 18 to 20 %. The seeds have twisted sides, are rounder at the top, 9-10 mm. long and -9 mm. wide. The hectolitre weighs 75 kg. Banat maize is rarely grown elsewhere than in Transylvania and Banat. Maize being a cleaning crop, is generally grown after the fertilisation of the soil, and precedes wheat. In most districts, and especially in Transylvania and Banat, the soil is ploughed deeply from the beginning of autumn, whereas in spring only the surface is lightly ploughed.

Sowing. — The date of sowing varies with the district. For instance, in the Wallachian plain and the hilly districts sowing may begin from the 1 April; in the mountainous regions it is delayed until 1 May. The maize is sown in different ways according to the districts. Broadcasting is general in Moldavia. Sowing is done by hand on the untilled field, and afterwards the seed is ploughed in and the soil well harrowed.

Sowing in clumps is mostly done in Wallachia, Oltenia and Transylvania. The work is carried out with a stake or with the foot during ploughing, by the sower, who at each step makes a hole with his stake in the furrow, throws in 4 or 5 maize seeds and covers them over with his foot.

The distance between each lot of seed averages 50-70 cm., and the distance between the rows is 60-70 cm. In Transylvania and Banat, maize is sown with special machines, especially on the large and medium-sized farms. Beans or marrows are generally grown between the rows of maize.

Cultivation. — When the maize has 4-5 leaves the soil is earthed up for the first time with the spade. As this work is important the small growers pay great attention to it. The second earthing up is done in most districts in Wallachia, as well as in Moldavia and Transylvania, with a light plough, especially in those districts where labour is scarce. But the work done by the plough is rough, and is always finished off with the spade, especially the work of earthing up.

The maize harvest is from 15 September and later, according to

the district. In Moldavia the entire plant is cut and made [illegible] sheaves, the ears being detached later on the threshing-floor; [illegible] some parts of Wallachia and Oltenia even the ears without [illegible] are pulled, the stalks being separated after the harvest.

The yield varied from 10-19 hl. per ha., according to the [illegible] of the soil and the climatic conditions. The stems average 2500-[illegible] kg. per ha. ; they are used by the small farmers as a cattle-feed [illegible]ing the winter.

Barley.

The statistical data show that the cultivation of barley in Rou[illegible]nia is considerable.

The largest areas under barley are in Bessarabia. In Wallach[illegible] Transylvania and some other districts where there are facilities [illegible] transport by land and water, it is only of secondary importan[illegible] the district of Constanta for instance has a cultivated area of 102,[illegible] ha. and produces 1,632,867 hl.

	Area in thousands of hectares	Yield in wagons	Yield per ha. in hl.
1920	1,400	147,195	10.5
1921	1,569	98,529	6.3
1922	1,727	322,622	11.8
1923	1,875	162,000	8.3

The above table shows that the area under barley is increasi[illegible] from year to year, and this is explained by the fact that bar ley be[illegible] exported free and without any restriction, there is a great dema[illegible] for it and high prices are obtained. The small growers, especia[illegible] those living in districts where there are ports, profit considera[illegible] from these concessions by the Government and have almost a[illegible]doned the growing of wheat, which is subjected to severe regulati[illegible] They have therefore replaced wheat by barley as is shown by t[illegible] following comparative table.

Wheat.

District	Hectares	Total production in hl.
Constanta	21,416	334,915
Braila	39,191	401,[illegible]
Cetatea Alba	70,070	1,120,[illegible]

PLATE XXXIV.

FIG. 76. — Barley, Imperial two-rowed.

PLATE XXXV.

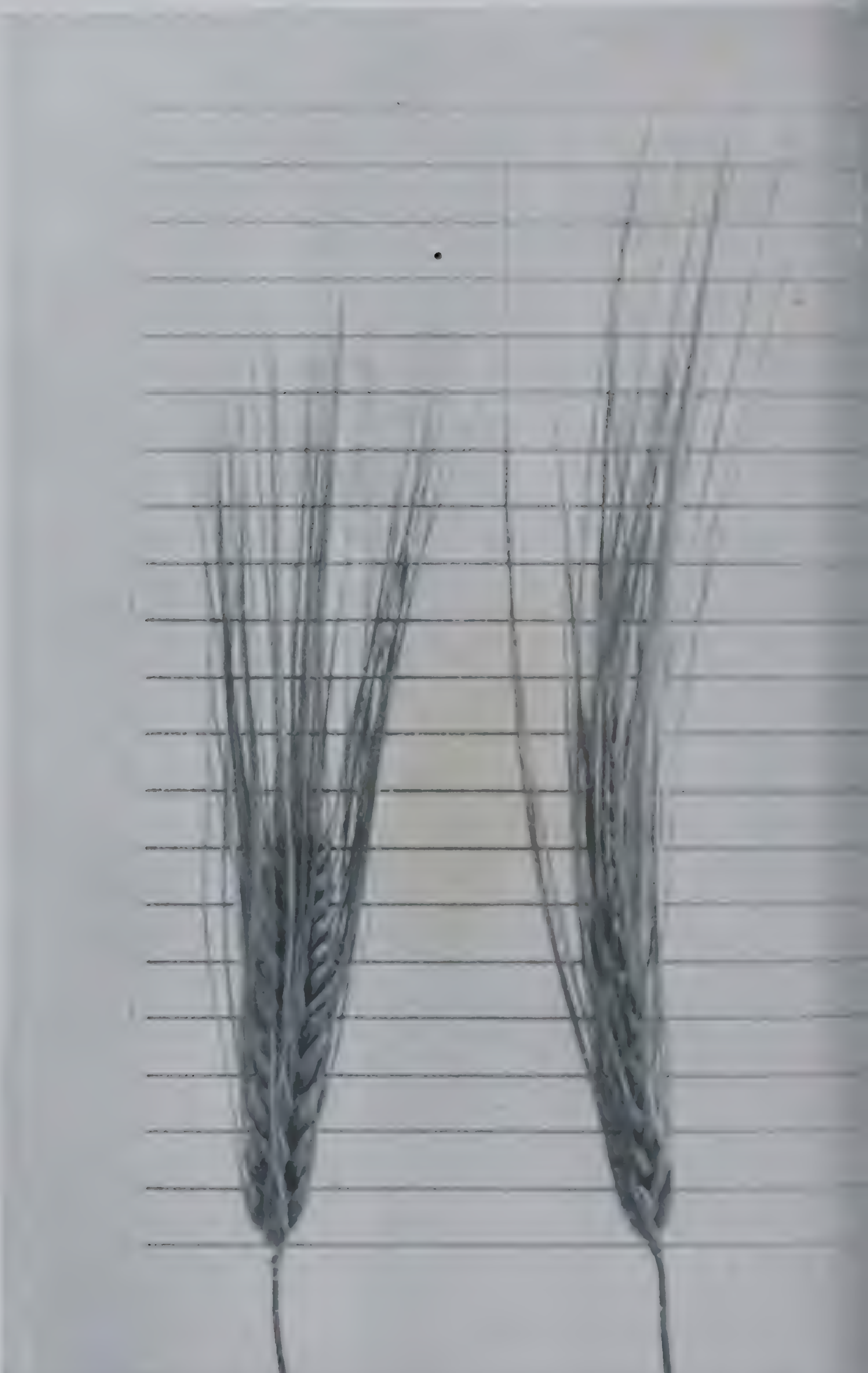

FIG. [illegible] — Barley, [illegible]

Barley.

District	Hectares	Total production in hl.
Constanta	183,384	1,632,867
Braila	102,836	1,155,189
Cetatea Alba	148,969	1,376,177

It is clear from this that the cultivation of barley is beginning o occupy the first place in some districts, especially on small farms.

The following species of barley are grown in Roumania :

Hordeum vulgare — common barley
" *distichon* — two-row barley.

The last-named, known as " Orzoica ", is grown mostly by the arge proprietors, as it is in demand by the brewers and obtains a igher market price. This variety is grown extensively in the disricts of Braila, Constanta, Tulcea and Ialomita. The area under wo-row and common spring barley is larger than that under winter arley ; the following were the statistics for this crop for the years 919-1923 :—

Year	Area	Average yield per ha.	Total production in hl.
1919-20	1,355,195	9.1	22,319,150
1920-21	1,503,705	9.7	14,603,778
1921-22	1,622,698	18.8	30,500,566
1922-23	1,783,374	11.2	20,026,770

Among the two-row species the following are grown : Chevalier, Ianna and Imperial (Plates XXXIII, XXXIV, Figs. 75 and 76), which are well acclimatised to Roumania.

Common barley is grown as a spring and winter cereal, the later in lesser quantity than the former. The small growers distinguish etween the four-row and six-row barleys belonging to this species. he six-row barley (Plate XXXV, Fig. 77) is but little grown. rowing and harvesting are carried out in the same manner as for wheat.

Oats.

Oats, like barley being exported free, their cultivation is pro[illegible] able and carried on largely by the small growers. The area un[illegible] oats is increasing yearly as is shown by the statistics published by t[illegible] Ministry of Agriculture :—

Old Kingdom.

Year	Thousands of ha.	Total production in wagons
1912	382	30,406
1913	522	55,143
1914	427	36,739
1915	431	43,447
1920	537	59,543
1921	661	59,817
1922	752	77,604
1923	787	46,500

Great Roumania.

Year	Thousands of ha.	Total production in wagons
1920	966	99,209
1921	1,329	96,317
1922	1,333	133,645
1923	1,345	92,500

This increase in the area under oats is one of the consequenc[illegible] of agrarian reform ; at the same time it is also due to the fact th[illegible] recent autumns have been very dry and the sowing of wheat at th[illegible] proper time has not been possible.

Varieties. The variety generally grown is a native species (Pla[illegible] XXXVI, Fig. 78) suitable for the Roumanian soil and climate. Amo[illegible] the improved foreign varieties the best adapted to Roumania ar[illegible] Svalöf Ligovo, Svalöf Sieges, Svalöf Goldregen. In the Timis-Toron[illegible] (Banat) district, winter oats are also grown ; they are earlier an[illegible] mature sooner than spring oats. This variety is adapted to th[illegible] Banat climate and gives a good quality of grain.

Oats are largely cultivated by small growers, especially tho[illegible] who live in the districts near the plain of the Danube, which is due to the high prices obtained at the ports.

Oats are generally sown in fields wich have been planted wi[illegible]

PLATE XXXVI.

FIG. 78. — Roumanian oats.

Plate XXXVII.

maize. The time of sowing is mostly during the early days of spring; 140 kg. per ha. are generally sown broadcast. In Transylvania, Banat, and Bucovina, however, sowing is largely done with drills, even by the small growers.

Harvesting is done in the same way as in the case of wheat.

The oat yield is generally small, and varies from one year to another owing to the frequent droughts. The average yield per ha. for the years 1920-1923 was:

Year	Average yield per ha.
1920	22.2
1921	16.6
1922	22.1
1923	16.1

Rye.

Rye is grown over a restricted area in Roumania, covering only 270,546 ha. in 1923, and yielding 22,500 wagons, an average of 8.7 hl. per ha. It is the only cereal which occupies a smaller area after the war than before.

By dividing the area under rye into districts, it will be seen that the area under this crop is more extensive where the soil is sandy, as in the districts of Dolj and Ialomita, those of Hotin, Balti and Orheiu in Bessarabia, and of Satmat and Bihor in Transylvania.

The following table gives the area and yield of rye in Roumania:

Year	Hectares	Wagons	Average per ha.
1920	315,603	23,902	7.6
1921	326,576	23,067	7.1
1922	266,523	23,384	8.7
1923	270,456	22,500	8.5

Rye is generally grown as a winter cereal. Among the varieties are: Roumanian rye (Plate XXXVII, Fig. 79), a hardy type suited to the climate and soil of the country, and Petkus rye.

Cultivation and harvesting are done in the same way as in the case of wheat.

Prof. ANASTASE MUNTEANU,
of the Academy of Agriculture, Cluj.

TWO EXPERIMENTS IN VINE-TRAINING IN LOWE[R] LANGUEDOC.

Madame and Monsieur Egisthe SILHOL, being anxious to be[q]... an estate of 62 hectares, situated at Aubord, 12 km. from Nî... to some institution of public welfare, chose the Agricultural Synd... of Gard, which undertook to cultivate the property. The Synd... appointed as Director of the Experimental Farm at Aubord, Mons... VILLARET, an agricultural expert and himself a land owner at B... voisin, in the immediate neighbourhood of Aubord. M. VILLA... who is highly skilled and experienced, is very actively engaged... carrying out the work in which he takes a keen personal interest.

The estate includes buildings, some of which are in good conditi... including the château, which contains nine rooms, and a cellar wit... capacity of 1000 hectolitres and stables of recent construction; ... remainder partly requires more or less extensive repair, or is fal... into ruin.

When the Syndicate took the estate in hand at the end of 19.. it possessed 6 hectares of vines, of which half only were in good co... dition, and about 5 hectares of old lucerne. The rest of the land h... been badly cultivated or neglected for several years.

The soil is of varying quality, from poor and pebbly alpine s... to the alluvial clay-chalk soil of the Vistre.

The Syndicate does not attempt to make profits but to carry o... experiments for the general benefit.

Visitors to Aubord can already follow the experiments wh... are in progress and always learn something of interest.

The results are reported in a monthly publication called " Le Ga... agricole " the result of the amalgamation of the " Bulletin de la S... ciété centrale d'agriculture du Gard ", " L'Agriculteur des Cévennes... and the " Bulletin du Syndicat agricole du Gard " and edited by t... Director of the Agricultural Service at Gard, M. F. CABANE, agr... cultural expert.

Since 1921 the estate has been cleared, planted with vines ...

ds and French plants and various grafting stocks), sown with ce-ls, laid out in lucerne fields etc., A piggery, poultry-farm etc., ve also bean installed.

The Departmental Office of Agriculture at Gard has contributed ierously towards the expenses of initial establishment and the Syn-ate hopes to be able to maintain itself in a very short time, keeping ays in view the principle that this farm should be specially organised experimental work.

The first experiments in vine-training have been undertaken on s estate.

First experiments in a vineyard at Aubord

Monsieur E. Cabane, Director of the Agricultural Service at rd, has contributed the following statement to a report on the work ne by the District and Departmental Agricultural Offices (page 3, in the Chapter entitled " Viticulture " (Vine Growing)]:

" A comparison between vinegrowing in vase form and training 6 wires with long pruning and continuous surface cultivation has en carried out in the same vineyard. The yields were as follows:

Vase form:	130	hl.	per	hectare	of	an	8.3° wine
Long pruning:	450	"	"	"	"	"	6.5° "

" This result proves that with long pruning, 6 wire trellising and rface cultivation, there is an enormous increase in quantity but a luction in strength. It is prudent therefore to adopt this " Maroger stem " on a part only of each vineyard ".

These tests were made on the 1923 harvest, and the document is thoritative, having been drawn up by M. Cabane, Director of the ricultural Service, and certified by M. Villaret, whose name has eady been mentioned.

The following figures are deserving of attention.

I. — On the one hand " vase " pruning yields 130 hl. of an 8.3° ne, i. e. 1.079 hectolitre degrees of alcohol.

II. — On the other hand long pruning yields 450 hl. of a 6.3° wine, 2.925 hectolitre degrees of alcohol.

While one owner, cultivating his Aramons in vase form, obtains yield of 100 hl. of alcohol, the other owner, adopting the Maroger thod, *on a lot of the same extent and on identical soil, obtains 271 hl. alcohol.*

These figures speak for themseves.

It should also be pointed out that the grapes were gathe the same time in each lot, and that these lots differ only as cultivation and pruning.

If the fruit on the staked lots had been gathered later, the of alcohol would certainly have been increased. Indeed, the " vines were approaching full maturity, whereas the long-pruned g were almost green.

In the latter case the fruit should have been left on the vine 20 days longer in order to allow the sugar to ferment as is the pra of the author on his own vineyard, on which harvesting begins w the neighbours have finished. If this practice had been followe the above case, much more alcohol would have been obtained.

SECOND TESTS ON TWO LOTS AT LIVIÈRES, P. H. AND P. B.

This test may be compared with another made on the auth estate at Livières, Calvisson (Gard) on two lots, the first called Fanabrègue, and at least 35 years old, and the second, the Amand 23 years old. Each of these lots is of about 1 hectare and they are parated from each other by a ditch. The Amandiers suffer gre from drought, the Fanabrègue much less.

THE FANABREGUE. — There are good grounds for fixing approximate age of the Fanabrègue. The bailiff, M. A. Visso remembers that he entered on his service at Livières 34 years ago, that his attention was especially called to two lots, the Fanabre and the Aire, trained on trellises.

The author was the first person in the district to attempt t method and was certainly a good deal criticised at the time. remembers perfectly well these two lots with their stakes and t lises. The Fanabrègue bore a fixed branch attached horizonta to the trellis. It was a species of Guyot pruning and wires were fi for cultivating in summer according to the author's ruling idea

The Fanabrègue, then, is very old. It has many faults, as is to understand. This lot was planted with grafting stocks w were *riparias*, but not yet the "*gloire*" variety. Some are st be seen in this lot. Each year a good many of the plants are re with *Rupestris Monticola*. In spite of all, this lot has freque given large yields.

(1) P. B. Low stakes (piquets bas). — P. H. High stakes (piquets hauts).

FIG. 80. — High stakes after pruning.

Plate XXXIX.

PLATE XL.

FIG. 82. — Low stakes after pruning.

Consequently, in these two lots there are alternate rows of
and P. H.

This alternation placed the two lots exactly on the same f
except as regards the height of the stakes and its conseque

The results are shewn in the following table :

Year	Fanabregues		Difference	Amandiers		Difference in favour of high stakes	Observ
	P.B.	P.H.		P.B.	P.H.		
	Hl. per ha	Hl. per ha		Hl. per ha	Hl. per ha		
1918	210	390	180				
1919	31	100	69	31	41	10	white frost
1920	400	432	32	172	212	40	
1921	193	262	69	185	224	39	hail
1922	161	251	90	179	261	82	frost in Nov
1923	235	273	38	171	202	31	
1924	122	151	29	129	147	18	
	1352	1859	507	867	1087	220	Total diffe favour of P 727 hl.

This table needs some comment.

It had long since been noticed that the vine branches f reached up to trees or any other support, while stocks which far from any support had neither such long nor fine shoots. Bea this in mind, the comparative test just described was made, the he of the stakes alone being varied.

In each of the Fanabrègue and Amandiers lots everythin strictly identical except the height of the wires.

The first row was left as it was, i.e. P.B., for all the old vines still on the P.B. system with 4 wires. All the stakes in the sec row were pulled up and P.H. set in place of P.B., the former 1 m. 60 from the ground and carrying 6 wires.

The third row is on the P.B., the fourth on the P.H. system and so

It may therefore be said that everything in the two lo exactly identical except the height of the stakes.

Even leaving out of account the first test on 167 stocks, it se that a test carried out over 6 consecutive years on two different l of 1 hectare each, should carry conviction.

The following are some of the results :

1 hectare was planted on the P.H. system (0.5 ha in Amandiers and 0.5 ha in the Fanabrègue).

PLATE XLI.

FIG. 83. — A fine bunch.

PLATE XLII.

FIG. 85. — Tractor showing method employed.

Plate XLIV.

1 hectare was planted on the P.B. system (0.5 ha in the Aman- and 05 ha in the Fanabrègue).

In 6 years the P.H. yielded 1469 + 1087 = 2556 hl. per ha.

In 6 years the P.B. yielded 1132 + 867 = 1999 hl. per ha.

The increase in yield of the P.H. over the P.B. is 557 hl., or

= 28 %.

The total yield at Livières during these 6 years was 27,738 hec- res.

If the whole of the vineyard had been on the P.H. system, there d have been an increase in yield of 7800 hectolitres (28 % of 0).

Taking 60 fcs. as the average price per hl., the owner would been richer by 7800 × 60 = 468,000 fcs.

There would therefore have been an additional annual profit,

n average, of $\frac{468,000}{6} = 78,000$ fcs.

Or again, approximately $\frac{78,000}{3378} = 2300$ fcs. per hectare per year ase in gross profit.

The figures are particularly striking.

Conclusions.

1. — The vase (*gobelet*) or cup (*godet*) form of pruning and all lar forms are the least satisfactory.

2. — The P.B. (training on 4 wire trellis) is a considerable im- ement on the above.

3. — The P.H. (training on 6 wire trellis) is superior to all the rs because it is the most thorough.

Special note. — In these two tests, the P.B. and P.H. are of tly the same age and receive in each lot the same cultivation, same care and treatment.

With alternating high and low rows, there should be no differ- and yet the respective yields of P.B. and P.H. show that the lts are not identical. This has been observed in a particular vine- l on 2 hectares in 6 years. What is the reason ? This would appear e a problem as yet unexplained.

It seems however that Nature, which is provident, distr
so to speak, to each plant the daily ration necessary in view
effort which it will put forth.

General note. — Whatever the system of pruning adopte
paramount advantages of cultivating at all seasons should ne
forgotten; these cultivations should lighten the soil to a de
5 cm. or at the most 6 cm.; they maintain the "drop of water
activate the soil microbes.

***

In conclusion the Author considers that the attention of re
should be called to the fundamental principles of the method.

1. — The moisture should be stored and retained as long as
sible.

2. — This can only be done by continual surface cultiv
throughout the year.

3. — In order to cultivate the soil at any season the bra
should not be allowed to run along the soil and the passage
tween the rows should always be kept free.

4. — Thanks to the espalier system of training, the syste
pruning can be adopted which uses the long branches of a y
growth, and is the only system which can ensure large and fairly
gular yields and enables the vine to utilise the supplies provide
nature.

5. — These conditions form a complete series or chain from w
nothing can be taken; if a single link is missing, the result is sp

The characteristic conditions of well-kept vines are:

No weeds;
No clods;
No cracks;
No plough furrows.

These rules, strictly applied in the two tests here desc
have led to the foregoing striking results and it is believed that o
trials will also lead to the same results.

E. MAROGER,

President of the Agricultural Bureau
District Councillor of the Vine-growers
President of the Vine-growing Sub-C
of Agriculture of Gard.

THE VINE-GROWING DISTRICTS OF RUSSIA.

There are three principal vine-growing districts in Russia, at derable distances apart. These districts are:

(1) South European Russia (Bessarabia, Ukraine, Crimea, Kuban, Stavropol, Astrakhan and Terek),

(2) Transcaucasia and

(3) Central Asia (or Turkestan).

Each of these provinces is divided into several districts accord- o the type of wine, each district having a different soil, differ- stocks and different methods of cultivation.

I. *Astrakhan* (552 hectares). — This was the first district in ia in which vine-growing, properly so-called, was carried out 513, this kind of cultivation was started by Czar MICHAEL FE- VITCH, the first of the Romanoffs. His son, ALEXIS MICHAELO- H organised in 1650, the first wine-making, and the Crown ards in 1656, provided grapes for the Imperial table and for irst time supplied the Court at Moscow with wine. Vine-grow- was further developed by PETER THE GREAT, 1700-1722, who ed his personal interest in the work while in Astrakhan during Persian military expedition.

He appointed a French expert, POSSIETE, to take charge of the ards and entrusted him with the improvement of the native and the introduction of the European plant. The vines and rs of the Crown prospered up to the end of the XVIIIth Cen- and offered an example to the people, who started growing vine in the country districts around Astrakhan, near the mouth ne River Volga.

After these early attempts at wine making and the improve- of the native vines the district specialized in high-quality ta- grapes that showed good keeping qualities in long distance d. The cultivation of this vine has not as yet been greatly loped; by means of the R. Volga however it supplies the

important cities of the North with table grapes to the exten
3 ½ million kg. per year.

Wine production has almost entirely stopped because of
competition of better wine-producing districts. The vineyards
grouped around the town of Astrakhan.

2. *Don* (12,580 hectares). — Vineyards are chiefly found
the left bank of the R. Don, starting with the village of Sch
(Stanitza), and as far as Bognievska, on the banks of the Don
near its mouth at Don; they have lately been extended over t
districts around Novotcherkask and Rostoff and the Don.

Special kinds of wine are made in these districts:

(1) The sparkling Trimlianskoie wine of the modern ty
A foreign traveller (1852) declared these wines to be very pleasa
(HOMMAIRE). It is popular in all districts of the S. Russian pla
and also with foreigners;

(2) A special kind of sweet wine made with raisins;

(3) A kind of wine made stronger by a process of freezi
(vimozozki);

(4) Ordinary light table wine, sharp in flavour and refreshi
which is the most abundantly produced. At the beginning of t
XIXth Century, instructors from the Rhine considerably influenc
the technical methods of vine-growing on the Don.

Unfortunately adulteration of the Don wines was extensiv
practised, and interfered with their success on the Russian marke
it was only in the XXth Century that the law against wine-adulte
ation and the efforts of the Cossack Government of the Don and
the Ministry of Agriculture, greatly improved wine-producti
which was gradually established on a foundation of suitable mode
technique. The Don wine production now entered upon the ri
path, but it has not yet reached its highest development. The fi
steps have been made towards organising co-operation in wine pr
duction under the direction of specialists. Development al
this line, and the law against adulteration will be the best mea
of securing the success of vine-growing in this province. The m
favoured Don wines among Russian consumers are the sparkli
types and the sweet wines containing 2.9 % of sugar and
of alcohol.

3. *Terek* (11,825 hectares). — Two regions producing wi
of very different type may be distinguished in this province. *Ki*
lar where wine production is more highly developed, with very

tensive vineyards which are the principal sources of wealth in the country and *Mozdok-Chelcovskain* the wine of which is quite rough and neutral (*tchikhir*), suitable for local consumption only, and not exported.

Kizlar used to export wine in considerable quantities by the Caspian Sea and the R. Volga, and its export of brandy made from vintage residues was still more important. The wine was most often produced by the addition of alcohol, as the natural wine of the region has no strength, owing to the frequent irrigation that is indispensable for the growth of its vineyards. In 1913 the amount of brandy added to Kizlar wine was fixed by law which also prohibited all adulteration.

An inferior quality of cognac, but one which is very popular in the northern provinces of the R. Volga, was produced by the Kizlar region from its own wine during recent years.

Wine making in this province is still at a very primitive stage and its organisation is only in the early stages. European stocks and technical methods of wine making are of late introduction.

The percentage of alcohol content in Terek wines is 8 to 10.

4. *Stavropol* (5,819 hectares). — The vineyards in this province lie along the banks of the Kouma river, and in the neighbourhood of the towns of Paraskovega and Ste. Croix. They are easily irrigated and produce an enormous quantity of wine of low alcoholic content (8°-10°), very sour and weak in extraction.

Vineyards cultivated without irrigation in the region of Piatigorsk have developed lately and produce an ordinary quality of table wine of average flavour, which improves after 3 or 4 years, in bottle. This district has already proved particularly suitable for the production of an excellent cognac. The sub-soil is very chalky. This quality of wine is very sour and of low alcoholic content (9-11°) and with a low extraction rate. In the Royal Family estates of this "Tempelhoff" region the production of natural cognac was started in 1908, according to a method of distillation used in the Charente and under the charge of a French expert, M. SAUVION, a native of the city of Cognac.

This cognac even when 4 to 6 years old, was of good quality but still finer after maturing for 8 to 10 years.

The first results of the new method were very encouraging, but the events of 1918 intervened and the entire cellar and stock of a

million litres of brandy and alcohol for its production was deter[illegible]
The future of brandy production in the district is very promising.

5. *Kouban* (8,376 hectares). — This province is more favour[illegible] situated for vine-growing than the above mentioned. Vine-grow[illegible] was resumed by the Russians at Eisk in 1848. Vineyards [illegible] spread over the banks of the R. Kouban and between the [illegible] and the Sea of Azoff. No special quality of wine is character[illegible] of the region, and the peasants gradually adopted the regular [illegible] nical methods. Anapa on the Black Sea is the best region in [illegible] whole province and has made a lasting name in connection [illegible] its exceptionally good white table wine, mainly extracted [illegible] Riesling grapes. It also produces a good quality of red Cab[illegible], but it is in the white table wine, sparkling and refreshing [illegible] a 10-12° alcohol content, good bouquet and body and matured [illegible] 4 to 5 years bottling, that the future promise of Anapa lies.

6. *Eastern shores of the Black Sea* (950 hectares). — This prov[illegible] which was annexed to Russia in 1829 was entirely abandoned [illegible] the Circassians in 1865. Then only were the Russian colon[illegible] able to re-establish their vineyards which flourished up to [illegible] Around Novorossiysk vineyards were established with Europ[illegible] stocks; there were no native vines left, all having been entir[illegible] destroyed by the Circassians.

The early pioneers were well acquainted with their busin[illegible] Dr. Pentachoul planted the first vineyards with Crimean vines [illegible] 1869, and his example was soon followed. The Royal Family [illegible] tate "Abraou Durceau" became the centre of wine making [illegible] this province in 1872. Shortly afterwards, the Russian plan[illegible] went south and new vineyards were planted as far as Sotchi, [illegible] ducing a good quality table wine carefully prepared according [illegible] the methods of modern technique and mainly under modern Fren[illegible] influence.

The sparkling Abraou wine proved the suitability of the re[illegible] for wine production. Table wines from Novorossiysk and [illegible] nendrix were already typical local products of excellent quality. [illegible] stocks most commonly adopted are the Riesling, the Semillon, [illegible] Aligoté and the Pinot for white wine, while the Cabernet and [illegible] Portugais produce a satisfactory red table wine. All these [illegible] qualities have an alcoholic content of 11°-12°, are rich in [illegible] have a high extraction rate and are very refreshing. The be[illegible] and sparkling white wine will prevail and become the characteri[illegible]

wine of this region. It can stand comparison with the Rhine wines as has been proved by frequent expert tasting of both wines together. The method of tasting was always the same; the wine samples were not labelled but simply numbered. After, both wines had been tasted and judged, notes were attached to each sample, the origin of which was then revealed and it often happened that the Abraou wines were declared to be of higher quality than the Rhine wines except in the highest grades.

7. *Crimea* (12,000 hectares). — BYONYERSKY in the XVIth Century, DUBOIS de MONTPEREUX in the XVIIth Century and PEYSSONEIL in the XVIIIth Century, bore witness to the good quality of the Crimean wines of their days.

However, after the XVIIIth Century wars, vine-growing was almost entire lyabandoned. In th 1783, the Crimea was united to Russia and vine-growing in the province once more prospered. The Russian Government encouraged and extended what remained of the Tartar vineyards. Large land owners, and more particularly Prince M. VORONTZOFF, largely developed vine cultivation, which made rapid strides after 1823. The best European stocks were introduced and were perfectly acclimatized. The Crimean vineyards soon became models to the rest of Russia and supplied other provinces with the material for establishing their own vineyards.

Development was checked by lack of experience in methods and in the selection of stocks, and the absence of specialized experts. The encouragement of the Ministry of Agriculture and shortly afterwards, the practical organisation of the wine-production on the Royal Family Estates (1889) revived the cultivation of the vine.

The Royal Family estates possessed in the Crimea, about 1914, more than 300 hectares of model vineyards and several cellars with all modern equipment. The principal Massandra cellar alone contained 40,000 hectolitres of wine in barrels and 1,000,000 litres in bottle. The Magaratch (Ministry of Agriculture) cellar and vineyards became the scientific centre of vine cultivation in Russia.

Is is clear that strong wines and liquors of the type of port, madeira, etc., with 16-18° alcoholic content, can be successfully produced from the vineyards on the southern shores of the Crimea. It can be safely affirmed that this class of wine will establish the reputation of the region for the future.

Further north and also on the sea shore, high quality table wines were produced, wines of good body and colour, high extraction

with a slight but pleasant earthy taste, sound and strong, an alcoholic content of 11-14°. Wines produced in the Valle Katcha, Koktebel, Otouze, Alma, etc., have far less body, and less alcoholic (9-11°).

The vine cultivation of the Crimea was very good, excep the Tartar vineyards of the valleys lying in the heart of the pe sula. The work of the local Zemstvo has been lately largely dev to improving the vine growing methods of the population an started the formation of vine growers co-operative unions.

The Crimea was the best developed and principal wine-prod region in Russia. Its special wines were already established only lacked time and full experimental research to develop definitely stabilize their characteristics.

7. *Ukraine* (20,440 hectares). — In the provinces of Ta (the Crimea excepted), of Kherson, of Podolia and of Ekaterina vine-growing only developed about the middle of the XIXth tury, when these steppe lands fell under the influence of Rus colonists. Large land owners introduced the best European st and these have already produced in certain districts table w and especially white wines, of very good quality. These dist for the most part produce a very ordinary quality of wine, of alcoholic content and mostly for local consumption. Here tech methods in the various processes of wine-making were very perfect and both the local Zemstvo and the Ministry of Agricu exerted every effort to put it on a sound foundation.

8. *Bessarabia* (66,596 hectares). — We know from both RODOTUS and STRABO that wine-making was a prosperous indu in this country several centuries before Christ. Its wine exp reached Muscovy and Poland in the XVIIth Century. At the t of annexation to Russia in 1812 however all the vineyards w in a sad state of neglect. The Russian Government took act steps to develop vine-growing and colonisation by Greeks, Bul Germans, Swiss and Russians, who took the place of the repatri Turks, did much for its progress. The efforts of Prince M. VOR ZOFF, of which mention has been made above, were particul successful. Large landowners introduced French, German Hungarian vines, built large cellars and organized a sound and equipped industry. A School of Wine-making was founded at schineff in 1844 and became a very important factor through

aining it gave to experts, and the practical impetus which it supplied to scientific and research work in oenology.

Vineyards increased steadily in Bessarabia, in spite of the attacks of serious diseases — such as Oidium (1852), Mildew (1884), Philloxera (1886), and in spite of dry summers and hard winters. About 1850, the province produced 480,000 hectolitres of wine; in 1870, 800 000 hl. and possessed 30,500 hectares of vines; in 1880, 5,000 hectares, and in 1897, 77,000 hectares and it was only at that date that phylloxera reduced the area under vines to 66,596 hectares.

Since 1896 more serious attention was bestowed on the cultivation of American vines and their grafting. A selection of stocks suited to Bessarabia was made, but the vineyards thus planted were slow in development owing to the poor production shown by the grafted stocks in comparison with expectation.

The best wine-producing region of Bessarabia is the Southern Akkerma district on the banks of the Dniester and at its mouth. Wines made here are of excellent quality with 10°-14° of alcohol. Second to this comes the Benderi district. The vineyards of the hills produce good wine but the plains give a poorer quality, with small alcoholic content (8-10°). The third, wine-producing region, the Ismael District, extending to the banks of the Danube, gives wine of inferior quality. There are a large number of vineyards near Kischineff and Orgyneff; here again, the vine of the hills gives good wine (both red and white) but that of the plain is of no commercial value. The best Bessarabian wines have an alcoholic content of 9-11°, are sweet with fair bouquet and distinct flavour, light bodied and quite pleasant as table wines. The more ordinary qualities form a good basis for the distillation of brandy. Both the production of cognac and the sale of the better quality Bessarabian table wines promise exceedingly well for the future.

9. *Transcaucasia* (84,175 hectares). — This province consists of Georgia, Armenia, Aberbeidra and Daguestan. Of these, Georgia is classed highest as regards wine production and is divided into three quite distinct regions: — (1) Kakhetia, most favoured of all the regions in Transcaucasia, (2) Karthalenia, (3) Imerethia.

Georgia's rich soil and very favourable climate produce a good quality wine, full bodied, strong, with high extraction and of a peculiar earthy taste, from the important native varieties of vines such as Rea-tziteli, Saperavi, Mzvané, Borouli, Adreouli, etc. Wine-

making with its primitive methods, flourished here as in Transcaucasia, several centuries before Christ. STRABO speaks of abundant quantities of good wines here in the second century before Christ. The vine held so high a place in the country that when St. Nina introduced Christianity into Georgia in the IVth Century the cross she carried in her hand when preaching was of vine wood.

The various conquerors of the Caucasus, the Arabs (VII-VIIIth Century A. D.) the Persians (IX-XIth Century A. D.), the Tchengis Khan and Tamerlane (XIII-XIVth Century A. D.) and again the Persians and afterwards the Turks (XVth Century A. D.), with their continual wars effectively put a stop to all vine cultivation in the country, and it was only when Georgia was annexed to Russia (1801) and peace reigned once more over the country, that vine-growing was resumed and prospered. It was the same Prince M. VORONTZOFF, Viceroy of the Caucasus (1844), who established some twenty experimental vine nurseries and introduced the best European stocks from the Crimea. But the stocks native to the country gave excellent wine and were therefore extensively cultivated.

Prince VORONTZOFF sent young Georgians and young Armenians to study vine-growing in the Magaratch School. He founded the Caucasus Agricultural Society which greatly encouraged the development of local wine-making. Moreover, the development of railways and main roads in 1871 largely assisted the industry. The Society helped the vinegrowers to control the new pests of oidium, mildew and phylloxera with suitable apparatus and sprays.

The first pioneers of European technical methods which gradually replaced the primitive methods of the native population were Count CHERENETIFF, the Princes DZORDZADZE and MUKHRANSKI, etc. The earthenware and other pots used for keeping wine were replaced by barrels, as a first step.

The Royal Family Estates also began work in 1887 by purchasing several large vineyards in Kakhetia and Karthalinia. They possessed in 1914, some 450 hectares of model vineyards in Georgia, with large, up to date cellars, and used for wine-making both the native and European stocks. Results from both were encouraging; the wines produced and matured under modern conditions showed special qualities, and only required time, and further experiment for their complete development. These wines somewhat resemble strong Burgundy types, with good colour and body, but rather heavy, and of high alcoholic content (10-13°).

The red Saperavi grape has already shown its capacity for ducing first class table wines. The white quality (Rea-tziteli), Cabernet and Bresiling, have also proved their value for the duction of wines that can be fairly compared with French wines, ecially after bottling for some 10 to 15 years.

The Karthalinia wines are milder (9-10°). The Imeritia wine s an alcohol ratio of 10° — rarely of 11°.

In Kakhetia where hail storms are frequent, the Royal Fam- Estates organised cannon shooting to ward off the hail showers. is system was installed at three separate stations about 20 kilo- tres apart and worked very successfully from 1900 to 1918. e firing apparatus (Quelin and Perras System) and its very simple angement proved in practice very effective, and the expense olved was far less than would have been the cost of the damage ich was avoided by its use. When in 1918, owing to political ents, the anti-hail firing was abandoned, the damage done to e vines by the hail was most marked and serious. The vineyards Napereouli and the neighbourhood, a region subject to frequent il storms were without any means of protection in 1920 and ere devastated by hail on three different occasions, after having joyed the protection of a firing apparatus for 18 years: — Previous the year 1900 hail storms devastated the region every two or three ars or so and the value of the anti-hail firing was fully demon- rated.

The cost of this means of protection amounted to no more than ½ % to 2 % of the average gross expenditure on each estate; 5 cannons sufficed for the protection of 120 hectares and a surround- ig area of some 20 kilometres, when placed behind the vineyards, acing the usual onset of the storms.

Wine production in Georgia and more especially in Kakhetia ives great promise for the future. Vineyards in Imeritia and Kar- halinia were attacked by phylloxera before the year 1900, and in Kakhetia, in 1913, and American stocks have begun to be used or their reconstruction.

Armenia. — The Province of Erivan produces a very strong uality of wine (11-14°) of the port type on the banks of the Arax, t Etchmiadzine and at Asrarak, and, in other districts, a milder rdinary table wine (10-12°) is made. Technical methods of pro- luction however still require improvement. The greater part of he wine produced was distilled into cognac, and brandy, as

"Stamura", ears white; caryopses, pale reddish white; culms 90-100 cm.; fairly high tillering strength; medium early.

"Italo Giglioli", ears white; caryopses yellowish red; culms 95-100 cm.; medium tillering; very early.

"Fausto Sestini", ears pale yellow; caryopses pale yellowish-white; culms about 110 cm.; average tillering; comparatively early ".

"Attilio Fabrini", ears white; caryopses red; culms 95-100 cm.; fairly early.

"Cuboni", ears milky white; caryopses pale reddish white; culms 95-100 cm,; average tillering; early.

SOFT AUTUMN WHEATS, AWNED. — "Francesco Strampelli" ears deep red; caryopses reddish white; culms 80-90 cm.; medium yield; fairly early.

"Carlottina Bianca", ears white, caryopses yellowish-red; culm 65 cm.; medium tillering; yield early.

"Carlottina Rossa", ears red; caryopses yellow flesh-coloured.

"Vittorio Veneto", ears dark red; caryopses yellow flesh-coloured; culms about 120 cm.; high tillering; normal ripening.

"San Michele"; ears deep yellow; caryopses yellow; culms about 110 cm.; high tillering; fairly early.

"Gorizia"; ears white; caryopses flesh coloured; culms about 90-10 cm.; normal ripening.

"Trieste", ears white; caryopses dull flesh coloured; culms 100-110 cm.; medium tillering; normal ripening.

"Trento", ears white; caryopses reddish-brown; culms 90-100 cm.; average tillering; somewhat early.

"Fiume", ears straw-coloured; caryopses reddish-brown; culms 110-115 cm.; tillering somewhat low; early.

"Zara", ears white; caryopses red; culms 115-130 cm.; normal tillering, somewhat early.

"Cantore", ears white; caryopses light yellow flesh coloured; culms 115-125 cm.; fine tillering; fairly early.

"Enrico Toti", ears red; caryopses light red, culms 85-90 cm.; medium tillering, fairly early.

"Villa Glori" ears dark red; caryopses reddish white; culms about 90 cm.; medium tillering; fairly early.

"Mentana", ears red; caryopses dull yellow flesh coloured; culms 90-100 cm.; normal tillering; fairly early.

"Goito", ears red; caryopses red; culms 90-100 cm.; high growing; fairly early.

"Palestro", ears red; caryopses light red; culms about 110 cm.; slightly early.

"Castelfidardo", ears deep yellow, caryopses light yellowish-brown; culms about 100 cm.; normal tillering; fairly early.

"Marsala", ears white; caryopses reddish; resistance to drought.

"Caprera", ears light reddish yellow; caryopses flesh coloured; resistance to drought.

"Calatafimi", ears deep yellow; resistance to drought.

HARD WHEATS. — "Volturno", ears bluish-black; caryopses red; normal tillering and ripening; high yield, even during drought.

"Milazzo", ears whitish; caryopses amber coloured; normal tillering and ripening; high yield.

"Senatore Cappelli", ears yellowish-white; caryopses; amber coloured, normal tillering and ripening.

Daini II to VIII; confined entirely to arid regions of southern Italy.

F. D.

346. **"Trigo sertanejo" a Wheat Grown at Montes Claros, Minas Geraes, Brazil.**

BARBOSA, J. Trigo sertanejo. *Revista Agricola, Industrial e Commercial Mineira*, Vol. I, part. 7, pp. 443-44. Bello Horizonte, 1923.

In the district of Montes Claros, wheat has been cultivated for over a hundred years with the result that a very fine, strong hardy type has been produced which is not subject to any disease and bears heavy crops. Dr. ALVES COSTA procured some seed of this variety and forwarded it to the Ministry of Agriculture at Rio de Janeiro, whence some of it was sent to the Centenary Exhibition (1922,) where it was greatly appreciated, while the rest was dispatched by the said Ministry to Señor H. KOBBE, Director of the "Campo de sementes" of S. Simão, State of São Paulo, who cultivated it and obtained results exceeding all expectations. The wheat was sown on May 29, 1923; it began to come up on June 4, and was harvested on October 25, 150 days after seeding. The yield was 19.3 quintals of grain per hectare, and 44.2 quintals per hectare of straw. The fact that this wheat can be sown in May enables it to be grown after the maize (the cereal at present most cultivated) has been carried.

F. D.

347. **Gluten Percentage in some American and Italian Wheats.**

ALTOMANI, P. Il contenuto in glutine in grani nazionali ed esteri. *Giornale di Agricoltura della Domenica*, Year XXXIV, No. 5, p. 38. Piacenza, 1924.

With a view to ascertain whether, or not, Italian grown wheat should be mixed with American wheat (in order to increase the gluten content of the former and make it more suited to bread-making), the author carried out a series of analyses in the Laboratory of Agricultural Chemistry of the Royal University of Bologna. The results, which are given, show that as a rule, American wheat does not contain a perceptibly larger percentage of gluten than Italian wheat, and indeed, some varieties of Italian wheat are superior to the American product in gluten percentage.

Italian flour satisfies all the requirements of the baker as regards the quantity, and especially the quality, of the gluten present. The author

the movement, and co-operation was beginning to exercise its beneficial influence among the small vineyard owners. The standard of experts was improving and their influence was being felt in the wine-making work in all the regions including the most backward. The Great War did little to weaken progress in vine-growing, though it removed many of the vineyard workers. Subsequent events have however caused a set back.

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ETEOROLOGICAL CONDITIONS AND PLANT DISEASES.

In its early stages the study of plant diseases resolved itself o little more than a study of the parasites. Later, the study of e host plant received greater prominence, as the truth that disease an indication of abnormal or disordered physiology became genilly recognised. Still more recently has come the recognition another truth, namely, that diseases caused by parasites are the anifestations of complex interactions of host and parasite under e influence of the conditions of a varying environment. Such contions may be designated "environmental factors".

No observant person who watches the incidence of plant diases can avoid noticing the marked influence of one group of environental factors, those included in what is rather vaguely termed the eather, on the prevalence of many of these diseases. To give ly one instance, the unusual prevalence of the powdery mildews Erysiphaceae) noticed in England in certain summers, such as that f 1921, is frequently ascribed to periods of dry, hot weather. At e same time, such a summer as that of 1921 was too dry for poato blight (*Phytophthora infestans*) to be severe in most parts of ngland. If these statements are true it is evident not only that isease is influenced by the weather, but also that different diseases re differently influenced by the same kind of weather.

Furthermore, if disease in any one country can vary from year o year under the influence of the annual fluctuations of the weather, e would expect to find that countries possessing different climates, hat is different *average* weather conditions, would show still more arked variations in the prevalence of their plant diseases, owing o the greater amplitude of the variations between different climates han between those of the weather of any single climate.

It might be expected that comparison between the plant diseases of areas with different climates would be difficult because he host plants would not be the same. However true this may be or the wild plants, it is much less true in regard to the major cultivat-

ed crops. The latter have been subjected to long periods of a
ficial selection in such a way as greatly to extend their original ra
Wheat and potatoes, for instance, are grown under very consider
differences in climatic conditions. Their parasites, on the o
hand, have not been subjected to the same human influence, and t
have had to follow the hosts as best they could. In the larger c
tinental areas, such as the United States and India, the wh
sorghum, maize, and potato areas are much greater than the a
in which certain of their parasites are found.

Weather and climate depend on the same set of factors —
ordinary meteorological factors of temperature, humidity, l
wind, etc. — and if it is desired to understand the relationship betw
meteorology and disease, an attempt must be made to eval
the influence of each of these factors on the interaction betw
host and parasite. Probably this influence is capable, in most ca
of exact evaluation, but the data are as yet somewhat sca
Temperature, humidity, and radiation are the chief factors ab
which data exist, and the following discussion will be confined
them.

The most difficult case is undoubtedly the study of the influ
on disease of variations in weather conditions from one year to
other within the same area. These variations are of lesser amplit
and duration than those between different climates, and m
frequently are not large enough to prevent the disease from appear
but merely influence its amount.

In India rust is present every year in probably every wh
field. Whether an epidemic outbreak occurs or not appears
depend entirely on the weather conditions of the year. These c
ditions were analysed by MORELAND (1) for 13 years in three selec
districts in the mid-Gangetic Plain. He concluded that the
ciding factor was the humidity of the air in January and Febr
(the crop being sown in October and harvested about April),
that in the districts with the earliest harvest, the earlier part of
period was more important than the later. My own observat
are in general agreement with these, except for the rather im
proviso that it is the humidity of the air within the crop th
of consequence. In a field at Pusa sown throughout with the s
variety of wheat, rust (*Puccinia triticina* and *P. glumarum*) was sev
in an area with a dense stand and almost absent towards the las
of the field where the growth was light. In the dense crop the

humidity was nearly 20 % higher, four inches above the ground than in the light crop, as tested by an experiment lasting between 7 and 8 hours on a dull day. The temperature was about 3° C. lower in the dense crop. Soil moisture determinations showed that there was much more moisture under the dense crop, especially from the 3rd to the 6th foot, and this was really the cause of the good growth, as soil moisture is the chief limiting factor in wheat growing at Pusa (2).

Another disease, which at Pusa is dependent on humidity or rather on the deposition of dew is the die-back of chillies (*Capsicum*), due to *Vermicularia Capsici* (3). This disease appears at the flowering season about the beginning of October and may do very great damage. It ceases abruptly about 4 to 6 weeks later. This is because it is dependent on the heavy dews of this period, accompanied by a moderately high temperature. Artificial inoculations only succeed in almost saturated conditions. Plants growing under shade escape, as the deposit of the dew is slight. Later on, as the temperature falls and dew is less copious, the disease ceases. Observations during six years suggest that the relative air humidity requisite to cause an outbreak of this disease during the flowering period is over 85 %. In three of these years, when it was below this figure in the second half of September, there was no disease.

Potato blight (*Phytophthora infestans*) in the Gangetic Plain is influenced by a somewhat more complex group of factors. It is usually absent, and only two outbreaks have occurred in the last 25 years. Under certain circumstances a considerable portion of the seed used is brought down from the Himalayas where, at altitudes from about 4,000 to 7,000 ft., blight is endemic. If the Plains temperature is sufficiently high, infected seed thus brought down becomes sterilized, as it is well known that *Phytophthora infestans* is easily killed by heat. In 1912 a large import of diseased seed occurred rather late in the season, which was unusually cool at sowing time (October). In late December there was much fog and cloud with a low temperature, and an epidemic was in progress in January 1913 (4). Attempts to carry the fungus in culture over the following hot weather at Pusa failed and in the fields also there was no disease next year.

In localities where potato blight is endemic the problem is much more difficult and the meteorologic conditions that govern its intensity are by no means fully understood. It is one of the cases

in which a good deal is known, thanks to the work of Melhus (9) and others, of the conditions of temperature and humidity that influence the life-history of the parasite. The optimum temperature for the germination of the spores is between 10° and 13°C. A frost sufficient to kill potato leaves will also kill the mycelium of the fungus. Its upper temperature limits are below those required to injure the tuber, as it will not survive even 4 hours at 120°F., and cannot long be kept alive in cultures maintained throughout at over 90°F. But its optimum temperature for growth is much higher than the germinative optimum, being about 24°C. Its moisture relations are not so exactly known, but like all its allies it requires a high humidity for successful germination; it cannot stand drying for long, and zoospores are formed as a rule only in drops or films of water. The period of motility of the zoospores is longer at low temperatures; they can swim for 20 hours at 5°C., but only for 1 hour at 20°C. If the meteorological factors that influence the disease acted only by influencing the parasite, we would expect to find outbreaks always occurring when a cool, damp period alternated with a warm period at a time of the year, say July, in England when there is usually some blight in most of the potato fields. The cool period would assist germination and prolong the life of the zoospores, thus aiding dissemination, while the succeeding warm period would stimulate the growth of the fungus in the tissues. If another cool, damp period followed when the new infections were in the sporing stage, we would get the process repeated in an accentuated degree, and several such oscillations would enormously multiply the attack. But it is not easy to find records of such a regular sequence of events, partly because the meteorological data are not sufficiently detailed but perhaps also partly because the influence of the weather factors on the potato plant itself have not been studied. It is known, however, that in at least certain areas in the United States an unusually cool summer is necessary for severe attacks (6). It is also almost confined to the north-east, being seldom found below 40° of N. latitude. In Europe it is prevalent north of 50°N. In all cases it is worst where the humidity is high. In localities like the Channel Islands and the west of Ireland the humidity conditions are usually suitable, and temperature is likely to be the controlling factor in most years.

Many other diseases caused by Oomycetes appear to be influenced by rather similar conditions, as most of the Peronosporaceae have similar temperature relations. In order to demonstrate the

liberation of zoospores in the Phycomycetes it has been the custom in Pusa to use chilled water during the warmer parts of the year. The downy mildew of the grape, caused by *Plasmopara viticola*, appears to be an exception, as most observers consider that it is worst in relatively high temperatures.

It would appear that black rot of the grape vine, caused by *Guignardia Bidwellii*, is a similar case. It is stated that severe infection only occurs when there is a cold snap with rain, followed by a warmer period. Though the temperature relations of the fungus have not been worked out, so far as I know, this is very suggestive of their being similar to those just mentioned.

Another group of diseases that appears to be closely influenced by weather conditions is the powdery mildews (Erysiphaceae). It has already been mentioned that they are sometimes said to be worse in England in dry years. I have noticed the same thing in India with regard to the pea mildew, *Erysiphe Polygoni*. More exact observations are rare. Losch (7) examined the prevalence of apple mildew in an orchard situated on the slope of a ravine in Wurtemberg. The slope faced S. E. The upper part was severely attacked but, as one descended, the mildew decreased until at the bottom it was insignificant. The rays of the sun struck full on the upper slope. They reached lower down later in the day and, at the bottom, shade remained all the forenoon. The upper part was very hot and dry, the bottom cool and moist. No evidence was obtained as to whether the host or the parasite was most influenced, nor whether different varieties of apple would be equally affected.

Oak mildew behaves in the same manner. It has been noted (8) to be more severe in the upper levels of sloping woods, and also in exposed localities. Neger (9) has found that it produces its conidia much more vigorously on shoots exposed to the light than on those in the shade. Exposure and sunny weather favour the disease, but the relative importance of the factors of drought and radiation have not been fully estimated.

In Italy it has been noticed that either a drying out of the soil or a sudden rise in temperature makes wheat susceptible to *Erysiphe graminis*. Rivera (10) believes that this is due to a lessening of turgescence and is therefore a reaction of the host plant and not of the parasite. He says it is particularly marked in rich soils where the plants have a relatively restricted root development and would naturally suffer from shortage of water or excessive transpiration.

A hot sun and dry conditions are inimical to certain species of *Oidium* and epidemics are only likely to occur when there is a rapid alternation of moisture and dryness.

In India, tobacco mildew (*Erysiphe Cichoracearum*) is practically confined to shaded plants and the cereal mildew is also worse under shade (11). Most experimenters with cereal cultures kept indoors, must have noticed the greater prevalence of mildew under such conditions than in the open. More diffuse light and the absence of air currents appear to be the causes, and exposure to light and air the remedy. The same has been noticed in regard to the vine *Oidium*, amd those on strawberry and cucumber. These apparent discrepancies might disappear on more exact knowledge of the actions of the different factors. The latter have not been studied in detail as regards their effect on the host-parasite complex, but they appear to be sufficiently marked to permit of exact evaluation. It seems likely that their action on the host is of greater importance than on the parasite, contrary to what appears to be the case with the downy mildews.

All these are cases of parasites primarily of the aerial parts of the plants. If we turn to those of the roots we find rather more exact knowledge. The problem is perhaps easier, as the environment is relatively more stable.

The earliest, and still one of the most complete, studies of the influence of temperature on a soil-dwelling parasite was made by BALLS in Egypt, in 1905-6, on the sore-shin disease (*Rhizoctonia Solani*) of cotton (12). The damage done by this disease is usually restricted to the first stages of development of the seedling. Once cork-formation begins damage ceases. Cotton is sown in Egypt at different times between the end of February and May. The earlier sowings may take about 12 days to appear above ground, while in the middle of April the seedlings may be up in 5 days. Growth of the cotton root increases with a rise of temperature, in an accelerated curve which ceases rather suddenly at about 37°C. The parasite — a fungus universally present in Egyptian soils — has a similar growth curve, ceasing very abruptly at about the same point, 37°C. It was determined with considerable probability, especially in the case of the fungus, that inhibition of growth at the higher temperature was due to auto-intoxication, of much the same type as the well-known staling phenomenon in bacterial cultures. The toxin is produced even at the lower temperatures, but is too slowly formed

to accumulate sufficiently to inhibit growth, unless the medium is scanty or the cultures are kept for longish periods, until the temperature approaches 37°. Then it is formed more rapidly than the fungus can stand, and growth ceases. When the fungus encounters the young tissues of the cotton seedling at a temperature of, say, 20°C., these are penetrated and the hyphae pass from cell to cell, destroying the tissues before the toxin has time to accumulate sufficiently to check their growth. But at temperatures approaching 33°C. auto-intoxication is more rapid and growth is delayed. At the same time, at this temperature (33°C.), the cotton plant has its vital activities near their optimum. Hence defensive cork-formation is vigorous and the parasite is checked after producing only a small scar. At 37°C. not even a scar is produced, growth of the fungus being entirely inhibited. Thus the late sown seedlings normally escape attack, but a cold spell of even a couple of days in May will cause the death of many of them. The seasonal prevalence of this disease in Egypt is therefore practically, a purely temperature reaction, affecting chiefly the parasite.

We can now leave the discussion of the influence of seasonal variations of weather on the incidence of disease, after noting that in few cases has there been a successful attempt to evaluate the influence of the different factors exactly. When we turn to those wider and more prolonged variations that constitute different climates, we find that greater success in this direction has been achieved.

In India a rice disease of great severity occurs in part of the great rice-growing tract at the head of the Bay of Bengal. It is not due to a fungus, but to a nematode worm (*Tylenchus angustus*) (13). Injury is confined to the parts of the plant above the water in which the rice is grown, and to reach these parts the worm must leave the water and climb up the plants. It is a pure ectoparasite, never entering the tissues. Experiments have proved that the worm is able to move on a dry surface, provided the relative air humidity is above some point between 90 and 95 %, probably near 93. Above this point it has the power to condense water, and it moves in the film surrounding it by a snake-like method of progression. Neither feeding nor reproduction are possible under totally immersed conditions, but only in damp air between 90 and 100 % relative humidity. Below 90 % it can neither move, nor feed, nor reproduce. Hence the disease is confined to areas of maximum air humidity during the summer and autumn months. It has been possible to correlate the

meteorological data from 6 reporting stations within the affected area, with the distribution of the disease and to forecast that the greater part of the rest of India, excluding parts of the Burma delta and some of the east coast districts, is not liable to become permanently infected.

The smuts of sorghum, particularly the grain smut (*Sphacelotheca Sorghi*), annually cause danage estimated at a million sterling in western India. They are also prevalent in the Punjab and submontane districts, but are unknown in the eastern half of the Gangetic Plain. KULKARNI (14) worked out the temperature relations of this disease. Sorghum has its optimum temperature for germination at about 37°C., at which temperature and suitable moisture the seedlings will be up in two days. At 20°C. they take about twice as long, and at 16°C. about three times. The spores of *Sphacelotheca Sorghi*, however, have their germinative optimum about 20° to 25°C., and germination falls off rapidly above 30°C., giving only 1 or 2 % at 37°C. Infection is only possible during the earliest stage of seedling development. At high temperatures not only is this stage shortened, but the smut spores germinate feebly. In incubator experiments no infection occurred at 40°C., whereas at 25° there was 50 to 60 %. In western India the main crop is sown at a time when the temperature is about 21° to 27°C., and naturally suffers severely. A second crop is often sown at a period when the temperature is over 30°C., and this suffers relatively little. At Pusa, in the eastern half of the Gangetic Plain, the temperature at sowing time ranges up to 38°C., and there is no natural sorghum smut, though by properly selecting the temperature at sowing time it can be artificially produced. In a comparative experiment seed grain was mixed with spores and divided into two lots. One sown at Jacobabad with an air temperature of 36° to 40°C. gave no smut. The other sown at Poona at 25°C. gave 65 % infection.

Wheat bunt (*Tilletia tritici* and *T. levis*) in India is a similar case. It is prevalent in Kashmir and along the Punjab foot-hills, occurs in the Punjab plains, but not severely, and is unknown further east or south. Bunt spores have a low optimum for germination (between 12° and 18°C.) and usually fail to germinate above 25°. In central and eastern India the temperature at sowing time is usually above 25°, while in northwestern India the temperature at sowing time is below. In the latter case it is low enough to permit the spores to germinate and infect the seedling, but further east and

south it is too high. HUNGERFORD (15), under Idaho conditions, found that the maximum degree of infection was obtained with a temperature of 9° to 12°C. and fairly high soil moisture.

Maize smut (*Ustilago Zeae*) has much the same distribution in India as bunt, but its temperature relations in that country have not been worked out. In America (16) it has been shown that the maximum for spore germination and the development of sporidia is between 36° and 38°C., so that it might be expected to be limited by high temperatures at sowing time in much the same way as sorghum smut, and its Indian distribution suggests that this is the case.

Thus there is a group of four of the major diseases of cultivated plants in India (potato blight, sorghum smut, wheat bunt, and maize smut) strictly limited in their normal distribution by the temperature relations of host and parasite, the influence on the parasite being the chief.

In the United States a great deal of information regarding the temperature and humidity relations of certain diseases has been accumulated during recent years. Only a few of the more striking cases, where a correlation with regional climatic conditions has been established, need be mentioned.

The seedling blight of maize and wheat caused by *Gibberella Saubinetii* is a severe disease in the United States, especially in the middle west. It was noticed that the southern part of the maize belt escaped this disease, as did also the northern part of the wheat belt. The temperature relations of the disease were recently worked out (17). Wheat and maize were grown in soil held constant at eight different temperatures from 8° to 36°C. and exposed to infection, with the result that the favourable soil temperatures for the infection of wheat were found to range from 12° to 28°C., the optimum being about 24°. Maize, on the other hand, was infected from 8° to 20°C., most severely from 12° to 16°. The reaction appears to be one of the host, not of the fungus (18). Like most soil *Fusaria* the latter has a relatively high optimum in culture (24° to 28°C.). At low temperatures in maize and at high temperatures in wheat, it was found that the cell-walls of the seedling long remained in an unthickened condition, easily penetrated by the fungus. At the higher temperatures in maize and at the lower temperatures in wheat, thickened cell, walls, which resist the fungus, are rapidly formed.

The temperature relations of a good many soil-dwelling parasites

have been worked out. In those attacking the potato, four species of *Fusarium* together with *Verticillium albo-atrum* have their growth optimum at about 25°, two species of *Fusarium* at 30°C. The latter two are the species that cause damage in the southern potato-growing region of the United States, *F. oxysporum* and *F. radicicola* (19). The cabbage yellows parasite, *F. conglutinans*, is one that requires a moderately high temperature to cause disease. At a soil temperature between 22° and 24°C., 97 out of 104 plants wilted, and between 10° and 16°, 1 out of 88 (20). *Fusarium Lini* infects flax chiefly between 20° and 30°C., and like the last disease its geographical distribution in America is limited accordingly (21). The tobacco wilt *Fusarium*, *F. oxysporum* var. *Nicotianal*, is the same, 28° to 31°C. being its optimum for infection (22), while little infection occurs at 15° or 34°. This limits its natural range to certain areas or to exceptionally hot seasons in other areas into which it may be introduced.

In these and many other cases the temperature relations of both host and parasite have been determined only for the underground system. Recently, however, it has been suggested that the air temperature to which the above-ground parts of the plant are exposed may be of importance. This has been established in the case of the *Fusarium* wilt of tomato (*F. Lycopersici*) (23). As in the case of the sore-shin of cotton the growth curves of the parasite and of the roots of the host are similar, the optimum being about 28°C. If the air temperature is held constant at 27° to 33°, fatal wilt develops at a soil temperature of 27° but not at 17° or 36°C. There is no external symptom of wilt if the air temperature is at 17°, no matter what the soil temperature may be, nor if the soil temperature is below 20° or above 34°, no matter what the air temperature may be, although both the host and the parasite can grow at these temperatures. Hence the disease is chiefly found, in America, in the Southern States and in England, in the hottest part of the year.

Onion smut (*Urocystis Cepulae*) is a similar case (24). According to the soil and air temperature used, onions can be grown with from 100 % to no smut as a result of inoculation. The reaction is believed to be chiefly one of the host plant. The seed will germinate over a wide range of soil temperature, from 10° to 31°C., but the best top growth is got with a soil temperature of about 25°C. Infection will occur at soil temperatures between 10° and 25°C., but little at 27°. At a soil and air temperature of 25° a great many plants will outgrow the attack, but at an air temperature even as

high as 30° to 33° infection can be got if the soil temperature is kept below 25°. In outdoor plantings infection was completely inhibited when the mean soil temperature reached 29°C. and increased steadily with lower temperature. This explains the geographical distribution of the disease in the United States, where it is absent from large areas in which onions are sown when the soil temperature is high.

Even mosaic diseases show definite temperature relations. In cucumber mosaic a high soil and air temperature favour the disease and the relations have been worked out in some detail by DOOLITTLE (25). JOHNSON (26) has given similar data in regard to the influence of air temperature on several mosaic diseases.

Humidity relations have not been worked out in so many cases in the United States.

In comparing oat rust (*Puccinia coronifera*) with mildew (*Erysiphe graminis*), FROMME (27) found that he could get no infection with the rust below 80 % relative humidity, and only 6 % at 93, taking infection at saturation to be 100. With the mildew, on the other hand, he got infection at from 75 to 80 % humidity.

LAURITZIN (28) found *P. graminis* on wheat still more restricted, as he got no infection at 92 % humidity and only succeeded at from 95 to 100 %. The same was required for *Colletotrichum Lindemuthianum* on beans, and nearly as high limits, 91 to 100 % for *Ascochyta Fagopyrum*.

Except in a few marked cases, such as potato blight (where temperature plays also a great part) and black rot of the vine, there has as yet been relatively little work done on humidity in relation to regional distribution. This is partly due to the greater complexity of the apparatus required for exact work. Thus, though we may believe that humidity is an important factor in the distribution of a disease in different climatic regions (as it certainly is in regard to its intensity in a given region) there is as yet little exact proof of this.

Still less have the finer details of the humidity relations of the host-parasite complex been worked out. There is just enough known to indicate that methodical research in this direction may give results of great interest. Thus PANTANELLI (29) has shown that infection of the vine leaf by *Plasmopara* is dependent on the condition of the stomata, being possible only when these are fairly widely open. Young leaves are immune because their stomata are

too narrow. So also in older leaves infection fails if the soil moisture is below 15 %, unless the air humidity is above 80 %. If the soil moisture is above 20 % the stomata open widely enough to permit infection at an air humidity above 40 %.

I have so far confined myself to the action of the individual factors on particular cases of disease. It would take too much space to examine climatic influences as a whole on the general characters of the parasitic flora of a region, such as the relative scarcity of the Erysiphaceae in the tropics. But one or two cases indicating the interest of general studies of this nature may be quoted.

In Tripoli, TROTTER (30) has made observations on the character of the fungus flora. It is a hot and dry area, ranging from a region of relatively small rainfall restricted to October to February near the coast, to a region of no, or only accidental, rain inland. Of 83 Basidiomycetes, in the wide sense, 62 are parasitic rusts and smuts, and of the whole fungus flora about 70 % are parasites. He suggests that the water requirements of the fungi have determined this altogether abnormal percentage of parasites, since the latter get their water from the host plants and are independent of the climatic shortage of water. Furthermore, species with a relatively short life-history predominate, especially the Deuteromycetes. Amongst the rusts an unusual number are short-cycle forms, and the same has been found for the Alpine rusts of Switzerland, the reason in both cases being the relatively short growth period that the climate permits.

Equally interesting data may be expected from ecological studies of the parasitic flora of different regions, a subject on which very little has been done. DUFRÉNOY (8) examined from this point of view the Barèges valley on the north of the Pyrenees. He studied the influence of altitude on the parasites of a certain number of plants found at all altitudes on the valley slopes, from the bottom to 2,000 m. He found three groups. In one, the parasite was equally prevalent at all altitudes (most Ascomycetes), in another it was more severe at the lower levels or confined to them (some rusts, potato parasites), and in the third it was found chiefly at the upper levels (oak mildew and some rusts). He concluded that radiation was the most important factor in influencing the vertical distribution of the parasites. Temperature was of importance in fixing the seasonal periodicity and the amount of damage caused to the host but had little effect on the presence or absence of the parasite.

The effects of shade were studied in some detail, and the chief interest in the work is the high importance given to the intensity and actinic power of the sun's radiation in influencing leaf parasites.

The practical interest and importance of the study of the relation between meteorological conditions and disease scarcely needs emphasis. In France (31) there has been for some time in operation a system of meteorological notifications from a central station at Montpellier, fed by some 60 recording substations, of the dates on which vine diseases are likely to appear and thus when spraying or sulphuring may be necessary. The notifications are based on a knowledge of the conditions influencing germination and infection, incubation in the tissues and subsequent sporulation, and are controlled by field observations at the Station. It is possible to predict sporulation seven days in advance, which gives ample time for protective measures. In Italy a similar service is operated from Turin (32).

In Germany the Biologische Reichsanstalt in Dahlem, Berlin, has established a laboratory for meteorology and phenology and has commenced the collection of data by means of a system of report cards issued throughout the country (33). A limited number of characteristic diseases are selected, and an attempt will be made to correlate their incidence and regional distribution with the isotherms and other meteorological data and with the annual fluctuations of the seasons. A search is also being made for indicator plants which may be found to have a reaction to seasonal conditions parallel with that of the parasites. HILTNER has already claimed that he can find a strict relation between the date at which snowdrops bloom and the extent of the plague of field mice which occurs from time to time in Bavaria.

The United States Weather Bureau is carrying on a large investigation to determine the effect of current meteorological factors on the growth of vegetation. As a part of this, systematic meteorological and phenological records are being kept at a number of centres with a view to determining the critical periods in the growth of crops and in the development of injurious insects and fungous diseases. Though the data are not as yet sufficient to yield much information regarding the incidence of diseases, some interesting correlations have been obtained, such as that potato blight makes its most rapid development when the daily average temperature is about 72°F. We have already seen that the optimum temperature of the parasite for growth in the host plant is about 24°C. or 75°F.

The object of this paper, however, is rather to stress the import-

ance of beginning at the other end —of first establishing the temperature and humidity relations of the parasite and host, singly and together, and only then, with the exact information thus gained, seeking the correlation with meteorological data.

The co-operation of the meteorological authorities will be required the moment it is sought to translate the results of such exact studies into practical application. Whether the meteorological data at present recorded are sufficient is doubtful. In India they are not, neither as regards temperature nor, still more, humidity. Even where the records are taken three times daily, a correction formula appears to be required. Several such formulae have been worked out for the mean temperature, but their application differ in different localities. For the purpose here indicated, not only the means but the duration of the daily extremes may be of the utmost importance, a low minimum, if sufficiently prolonged, being perhaps sufficient to start a parasitic attack, though it might not be revealed in the daily mean if counterbalanced by a hot day.

In this brief review many points of great interest, as, for instance, the fascinating problem of the overwintering of the cereal rusts, have been omitted. No attempt has been made to do more than give examples of various aspects of the influence of environmental factors on plant disease. Field observations on the seasonal and regional occurrence of diseases have, no doubt, a certain value, but the trend of recent work has been to show that definite conclusions cannot safely be drawn from such observations unless they are controlled and elucidated by the more exact methods of laboratory research.

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AGRICULTURE IN HOLLAND.

Holland has a total area of 3 268 000 hectares of which 27.3 % is arable land, 38.2 % permanent grass-land, 3 % gardens, 7.6 % forests and 13.8 % waste land.

The remaining territory is occupied by water and banks, roads and railways, buildings and estates, and the lands immediately bordering on the dykes and marshes.

The modifications which have taken place in the course of the last 90 years will be seen from the following table:

	1833	1880	1893
	ha.	ha.	ha.
Arable land and gardens	803,000	916,000	989,000
Grass land	1,093,000	1,126,000	1,249,000
Forest	169,000	223,000	250,000
Uncultivated land	907,000	712,000	450,000

The above table shows that the area of permanent grass-land is much larger than that of arable land. In 3 only out of the 11 provinces of Holland, *i. e.* Groeningen, Zeeland and Limburg, does arable land predominate.

The area of uncultivated land has decreased in recent years at an average of about 7000 ha. yearly owing to clearances and transformation into arable, grass and forest land.

Agriculture.

The following table gives a summary of the various crops grown on arable land and their yield:

TABLE II. — *Areas sown, total yield and yield per ha of the principal crops grown in 1923.*

	Cultivated area ha.	Yield total		Yield per ha
Winter wheat	58,287	2,071,051	hl.	[illegible]
Spring wheat	3,896	117,713	»	[illegible]
Rye	210,128	5,134,816	»	24.4
Winter barley	12,282	547,492	»	[illegible]
Spring barley	11,499	491,947	»	[illegible]
Oats	154,024	6,569,022	»	[illegible]
Buckwheat	3,077	42,852	»	[illegible]
Total under cereals	453,193			
Broad beans and kidney beans	17,452	505,740	hl.	[illegible]
Peas	34,909	1,027,889	»	[illegible]
Dwarf beans	8,062	148,993	»	[illegible]
Total under legumes	60,403			
Rape seed	2,120	67,026	hl.	[illegible]
Black mustard seed	245	4,682	»	[illegible]
White mustard seed	1,182	25,760	»	[illegible]
Caraway seed	4,076	66,179	Sacks of 50 kg.	[illegible]
Poppy seed	3,529	3,433,390	kg.	[illegible]
Flax	10,083	7,199	Fibre kg.	[illegible]
		91,089	Linseed hl.	[illegible]
Canary seed	991	19,557	»	[illegible]
Agricultural and horticultural seed	5,261	—	»	—
Other market crops	3,056	—	»	—
Total market crops	30,543			
Potatoes	131,757	27,287,163	hl.	[illegible]
Starch potatoes	29,350	10,362,825	»	[illegible]
Sugar beets	67,497	1,720,234	(per 1000 kg.)	[illegible]
Mangolds	35,314	—		—
Swedes and turnips	10,571	—		—
Fodder carrots	2,194	—		—
Chicory	865	15,676	(per 1000 kg.)	[illegible]
Onions	2,957	884,538	hl.	[illegible]
Other roots	919	—		—
Total under roots	281,424			

A large part of the various agricultural products is employed as cattle-feed.

This statement applies not only to clover, sown meadows and forage crops, which cover a total area of 63 500 ha. and to 48 000 ha. of turnips and other roots, but also to the 154 000 ha. of oats, which are exclusively used as cattle-feed. In addition the 210 000 ha. of rye, barley and beans are mostly converted into live-stock feeds.

The following are the principal exported agricultural products: peas, beans, various seeds, especially caraway and poppy, flax, potatoes, potato starch, sugar, onions and straw cardboard.

Though, as shown by Table I, the area of arable land has not much increased since 1880, a much higher yield is shown since that date, owing to the successful combination of practical agricultural with the knowledge of agricultural science which has been imparted to the peasant class by the public authorities through the dissemination of instruction on agricultural questions.

Production has been largely increased by the adoption of excellent methods of cultivation, the intensive employment of artificial fertilisers and the use of the most productive species and varieties of seeds and plants.

This is clearly brought out in the following table (see page 388).

The average yield of wheat per ha. therefore improved as from the period from 1851-60, to the extent of about 70 %, thanks to the sowing of the productive species "Wilhelmina" wheat, obtained by Prof. Dr. N. L. BROCKEMS in 1901 by crossing two other varieties.

The yield of rye and oats increased 37 %, and potatoes 100 %, regard being paid to the fact that the respective areas occupied by edible and industrial potatoes are in the proportion of 131 : 29.

The intensification of agriculture, as shown above was also indicated by an important change in agricultural method, which, especially after 1880, was particularly directed towards the exportation, not only of field products as above, but equally also of live-stock products.

The decreased production of crops such as wheat, barley, field beans and rape seeds corresponds with the increased production of products for direct exportation, including potatoes (potato starch) sugar beets (sugar) and peas, and of other crops such as oats and rye, which, as converted into livestock products, are partially used in connection with exportation.

TABLE III. — *Average yield of the principal crops for each decade of the period 1851-1920.*

Crops	1911–20	1901–10	1891–900	1881–190	1871–80	1861–70	1851–60	[illegible]
Winter wheat	32.9	29.4	24.9	23.4	22.7	21.0	[illegible]	hl
Spring wheat	32.9	31.5						
Rye	24.4	23.5	21.0	19.1	17.2	17.2	18.0	»
Winter barley	42.2	44.5	41.8	40.4	39.1	37.7	32.8	»
Spring barley	35.3	36.0	32.0	29.7	28.9	—	—	»
Oats	44.6	47.8	42.2	38.4	35.3	33.7	32.4	»
Field beans	27.3	27.1	23.8	26.1	21.3	20.1	21.3	»
Peas	25.3	24.8	23.4	21.7	19.6	22.6	17.2	»
Dwarf beans	26.0	25.1	22.3	19.7	18.0	17.9	—	»
Rape seed	26.8	28.2	24.7	23.6	21.1	20.8	18.5	»
Caraway seed	24.9	24.8	21.9	—	—	—	—	Sacks of 50 kg
Black mustard seed	19.4	19.0	18.0	—	—	—	—	hl.
White mustard seed	20.9	23.8	20.2	—	—	—	—	»
Flax fibre	59.2	622.0	486.0	462.0	393.0	—	—	kg.
Flax linseed	9.4	9.2	8.6	9.0	8.7	—	—	hl.
Canary seed	26.4	27.1	21.5	23.7	22.1	22.2	—	»
Potatoes	220.0	176.0	181.0	153.0	125.0	136.0	120.0	»
Starch potatoes	345.0	350.0						
Sugar beets	30.5	30.4	30.1	—	—	—	—	1000 kg.
Chicory	25.9	23.2	21.6	20.8	18.8	16.6	—	»
Seed onions	308.0	291.0	—	—	—	—	—	hl.

The following table will give an idea of the development of this change in method:

TABLE IV. — *Area sown with certain crops at 3 different periods.*

Crops	1911–1920	1881–1890	[illegible]
	ha.	ha.	ha.
Wheat	59,445	86,692	[illegible]
Barley	24,912	45,940	[illegible]
Field beans	19,255	35,438	[illegible]
Rape	2,767	7,655	[illegible]
Potatoes	175,408	144,296	[illegible]
Sugar beets	5,689	20,320	[illegible]
			(in [illegible])
Dwarf beans	10,848	2,890	[illegible]
Peas	29,347	23,004	[illegible]
Oats	147,327	116,280	[illegible]
Rye	211,080	202,046	[illegible]

In consequence of this change and also of the considerable increase in horticultural production, much more employment has been found in agriculture than previously, and, as the products were exported, the work has been paid for by the importing countries. In view of the dense and ever increasing population of the country, this factor must be considered as of great economic importance.

STOCK-RAISING AND PREPARATION OF MILK-PRODUCTS.

Cattle-breeding is the most important branch of Dutch agriculture; not only, as has already been said, is the proportion between the area of permanent grassland as compared with that of arable land as 38.2 : 27.3, but as also stated above, a large part of the soil cultivated is used for growing cattle-feeds.

In view, however, of the great development in cattle-breeding these factors are not in themselves sufficient to maintain a head of livestock such as that of Holland. Enormous quantities of feeds are imported from abroad and converted in Holland into meat and milk products, so that cattle-raising resembles in some respects an industry dependent for its raw material on foreign countries.

Mainly as a result of this extensive importation, it has been possible to develop the raising of livestock to the extent shown in the following table (see page 390).

As will be seen from the above figures, the increase has been mostly of cattle, swine and poultry. Owing to the continual clearing of moorland, the raising of moorland sheep has been greatly reduced.

The increasing numbers of sheep raised on more productive "polders" has however almost counterbalanced this decrease.

Horse-breeding has shown continual progress.

Dutch cattle are known throughout the world for the abundance of their milk yield. The exportation of breeding cattle is consequently very important, and in 1913, breeding cattle were exported into 16 European countries and 11 countries outside Europe.

In 1923 as many as 519 breeding societies throughout the country were carrying on breeding on scientific principles.

A large proportion of the milk-products is exported.

TABLE V. — *Head of Livestock according to the cattle census returns from 1851-1921.*

Species	Average in December for the years						Average May-June for the years	
	1851–1865	1866–1870	1871–1880	1881–1890	1891–1900	1904	1914	1921
Horses, over 3 years	—	210,677	215,941	218,596	215,260	221,779	238,566	258,333
Horses, under 3 year	—	42,775	48,298	53,394	58,779	73,498	88,811	105,335
Total	242,532	253,452	264,239	271,990	274,039	295,277	327,377	363,668
Service bulls	—	14,285	16,294	17,728	18,919	18,183	23,309	25,785
Milch cows and cows in calf	—	895,972	911,011	893,848	919,365	973,098	1,068,364	1,085,713
Butchers' beasts, cows and oxen	—	67,673	74,569	77,645	71,138	64,762	97,688	63,432
Butchers' beasts, calves	—						47,085	19,597
Other young calves	—	391,018	436,185	496,501	565,118	634,420	790,499	868,244
Total	1,286,808	1,368,946	1,438,059	1,485,722	1,574,570	1,690,463	2,026,942	2,062,771
Lambs	—	—	—	—	237,319	218,101	405,954	315,379
Sheep grazing on moorland	—	—	—	—	220,241	148,465	113,933	64,861
Other sheep	—	—	—	—	271,407	240,219	360,149	287,971
Total	847,628	976,436	895,826	733,169	728,967	606,785	880,036	668,211
Goats	100,972	132,186	150,196	158,312	171,842	165,497	224,231	[illegible]
Swine	(1) 262,817	(1) 308,635	(1) 457,527	(1) 647,287	(1) 641,281	(1) 861,840	1,350,844	1,519,[illegible]
Poultry, chickens	—	1,180,050	2,224,103	2,712,780	3,606,502	4,931,912	3,[illegible]	3,817,8[illegible]
Poultry, ducks	—						[illegible]	[illegible]
Straw and wooden hives	—	214,834	203,914	135,893	[illegible]	111,[illegible]	[illegible]	[illegible]

(1) [illegible]

In 1923 the following milk-products, in addition to 4.5 million kg. of fresh milk, were sent into the territory of the Ruhr (Germany):

22.9 million kg. of whole milk condensed and sweetened
75.8 " " " milk, skimmed and sweetened
4.1 " " " whole milk powder
2.2 " " " skimmed milk powder,

representing a total value of 48.5 million florins, or, deducting the cost of sugar, 29.7 million florins.

Also:

23.9 million kg. of butter valued at 41.3 million florins;
62 million kg. of cheese valued at 54.2 million florins.

The total production of butter was 69.4 million kg. and of cheese 105.5 million kg.

In addition to milk-products, livestock and meat were also exported.

In 1923 the exportation of livestock was comparatively small, being 24,000 head as against 118,000 during the previous year, when Belgium and France imported large numbers of cattle for restocking; in 1923 also 9.3 million kg. of fresh meat were exported.

In Holland, at the present time, butter is mostly made at the dairies. In 1923 there were 950 dairies, of which 627 were co-operative. Cheese is still to a great extent made on the farms. In order to encourage the trade in pure butter and cheese, the Dutch producers have, with the aid of the Government, introduced a system of tests. Products thus tested are authorised to bear a Government stamp, and the export of butter and cheese not bearing this stamp is prohibited. The by-products of the butter and cheese industries (butter-milk and whey) are generally utilised as swine feeds, and are excellent for the young animals. The breeding of horned cattle and swine farming generally show a parallel development.

According to the livestock returns for 1921, there were 1,519,000 head of swine in the Country.

Basing on the total number of breeding sows, which was then 147,000 as against 227,000 in 1923, the total number of swine must at present be very large, this being explained by the fact that in 1921 the stock of swine, which during the war had fallen to an insignificant number, had not up to that time been entirely replaced. Pork is an important item of export and 335 million kg. were exported in 1923, in addition to about 72,000 live animals.

Sheep farming combined with the breeding of horned cattle is important, especially in the pasture districts of the provinces of Noord-Holland, Zuid-Holland and Friesland. In these regions the "Texel sheep" is a special favourite and thrives very well on pasture providing both wool and meat of excellent quality.

Methods of horse-breeding have undergone an important modification within recent years; formerly the heavy carriage-horse, bred on account of its strength and speed, was most common. At present the heavy draught-horse, as also bred in Belgium, is coming more and more into favour and is already extensively bred.

Dutch horse-breeders in a comparatively short time have achieved magnificent results, and have spared neither expense nor effort and have shown marked ability.

The Dutch draught-horse is already known beyond the frontier and is a favourite with buyers.

Scientific poultry-farming has assumed great importance, especially in recent years, and forms a considerable source of revenue for the small producer. The development of poultry-breeding is shown by the fact that, in addition to the eggs used for home consumption, the exports of eggs in 1923 were of the value of 12,288,000 florins.

Size of Farms.

The intensive character of the agriculture and stock-breeding in Holland is partly due to the fact that the small farm is the rule and the large farm the exception. As will appear from the agricultural returns for 1921, the small farms show a further increase in number since the previous return (1910).

By dividing the farmers into 6 classes, the following table is obtained:

	1910	1921	Increase or [illegible]
	ha.	ha.	%
1–5 ha.	109,620	112,607	+ [illegible]
5–10 "	41,439	48,945	+ 18.1
10–20 "	30,821	34,509	+ 12.0
20–50 "	23,798	22,692	— 4.6
50–100 "	3,278	2,646	— 10.3
Over 100 "	216	250	+ 15.[illegible]
Total . . .	209,172	221,649	+ 6.0

These figures show that the number of farms of from 5 to 10 ha. and from 10 to 20 ha. has greatly increased and that this increase has been clearly at the expense of the larger farms of from 50 to 100 ha.

The increased percentage of farms of more than 100 ha. is also great, but their number, 250 is relatively very small.

This last increase is probably due to the formation of some large farms after the clearing of land.

Besides the number of farms in each of these divisions according to size, it is also important to know the area of land utilised in each of these divisions.

The following short table will provide this information:

	1910	1921	Increase or decrease
	ha.	ha.	%
1–5 ha.	256,655	274,327	+ 6.9
5–10 »	287,230	338,345	+ 17.8
10–20 »	426,598	475,939	+ 11.6
20–50 »	702,647	665,988	— 5.2
50–100 »	202,111	162,267	— 19.7
Over 100 »	34,472	41,319	+ 19.9
Total . . .	1,909,713	1,958,184	+ 2.5

This table indicates that a movement very similar to that which is shown in the previous table has taken place; it will be noticed however that the area utilised by farms of from 1 to 5 ha. has increased to a much greater extent than the number of the farms themselves. This phenomenon may be explained by a displacement in favour of the larger farms in connection with a decrease in the number of farm workers who have themselves become farmers, this being the usual objective of Dutch farm labourers. The extension of horticulture, for which the areas worked are nearly always from 1 to 5 ha., must also have had some influence on the increase of this class of farm.

There is also a connection between the size of farms in Holland and the nature of the soil. Where the soil is more difficult to till and consequently a comparatively large number of horses must be employed, the farms are generally larger; next come the pasture districts, where a minimum of labour per ha. is required.

The following small table gives the relative figures.

Average size of farms.

	1910	1921
Marine clay	22.27 ha.	19.35 ha.
river clay.	9.46 "	8.85 "
pasture	15.95 "	14.65 "
sandy soil	7.67 "	7.59 "
peat	13.94 "	13.93 "

Forms of tenure.

On comparing the agricultural returns for 1910 and 1921 it is to be noticed that during these periods ownership of land farmed has increased, while tenancy occupation has decreased. Of all those farming more than 1 ha., in 1910 50.83 %, and in 1921 56.02 were owners ; and of the area of land farmed by them, in 1910 47.17 % and in 1921 51.89 % was their own property.

The following table shows the proportion of owned lands included under the 6 types of farms as already classified according to size.

	Total % of farms worked by owners		% of land farmed by owners out of the total area in each of the groups according to size	
	1910	1921	1910	1921
1–5 ha.	50.42	56.56	50.55	55.82
5–10 »	55.84	59.82	54.52	57.58
10–20 »	52.44	55.76	51.21	54.13
20–30 »	43.89	47.62	42.25	46.[illegible]
50–100 »	37.43	46.11	37.76	[illegible]
Over 100 »	63.43	64.00	66.20	[illegible]
Total . . .	50.83	56.02	47.17	51.89

From both these tables it is seen that freehold exceeds leasehold, and this also accounts for the fact that agriculture has become highly intensive.

Co-operation.

The disadvantages and difficulties arising from a lack of working capital, the purchase of raw material (cattle-feeds and fertilisers

e conversion and sale of products, the use of costly agricultural implements, etc., have been to a great extent overcome by the formation co-operative societies among the small farmers.

Consequently agricultural co-operation in Holland has reached high stage of development as is shown by the following figures:

ief summary of the commercial transactions of Local Agricultural Loan Banks, current accounts at the close of the year of the three principal Central Loan Banks.

Savings deposited to 31 December 1923	Advances at 31 December 1923	Current accounts in 1923	
		deposits	withdrawals
Fl.	Fl.	Fl.	Fl.
294,813,000	126,672,000	143,466,000	150,563,000

From an enquiry made in 1920, it appeared that the following ırchases has been made during the year through the agency of ›-operative societies:

chemical fertiliser, value Fl. 3,827,000;
cattle feeds, value Fl. 40,238,000;
seeds, value Fl. 1,839,000;
and other goods, value Fl. 1,068,000.

These co-operative purchases represent a total of Fl. 3670 per 00 ha. of arable soil, grassland and gardens. In 1923 out of 951 ıctories of milk-products, 627 were cooperative; 60 to 65 % of the ıgar beets are treated in co-operative sugar factories; about 90 % f the total potato starch production is manufactured in co-operative ıctories, and 9 out of the 17 straw cardboard factories are coperative.

Sales by co-operative Societies, which may perhaps be greatly xtended, have already attained a notable development; for instance, ven during the unfavourable year 1923, the turnover of one co-oper-.tive society alone, that of Frise, for the exportation of milk products, vas Fl. 23,000,000, while auction sales of vegetables and fruit realsed Fl. 53,000,000.

The co-operative form of insurance has been largely adopted, as s shown by two examples; in 1923, horses and cattle alone were

insured for a sum of Fl. 133 millions on the mutual system, the mutual insurance against hail rose to Fl. 52 millions.

Where the small farmers are unable to procure expensive agri- cultural machines, or where such machines are too seldom used on the farms to be economically advantageous, they must to an ever increasing extent procure them for use in common and at the common expense.

Horticulture.

Horticulture holds an important place alongside of agriculture and cattle-breeding.

The climate, soil conditions, rainfall, the numerous canals and navigable rivers which provide an easy and cheap means of transport to the various centres, are factors which help to make horticulture in Holland a profitable concern.

The geographical position of Holland, between countries such as Germany, Belgium and England with their dense industrial popu- lations, also contributes to render Holland the market garden of part of Western Europe.

Employers and workers, well qualified by knowledge and experience, have been able to bring horticulture to a high state of perfection, while the Dutch commercial spirit has always endeavoured to ascertain the requirements of buyers, and the growers, for their part, have made every effort to conform to these requirements.

Market-gardening, fruit growing, nursery gardening and floricul- ture, in which the well known bulb industry is of great importance, are among the principal branches of Dutch horticulture, followed by the production of vegetable and flower seeds.

The chief markets for vegetables and fruit, in addition to those grown for home consumption, are Germany and England. Hot- house products, fruit and ornamental trees and shrubs are exported to various countries in Europe and beyond.

The same applies to cut flowers and plants, while flower-bulbs are sent all over the world.

Horticulture has become highly intensive. Whole regions, especially in the province of Zuid-Holland, are given over to culture under glass; in many cases box-culture is practised, so that through- out the greater part of the year fresh flowers, vegetables and grapes may be obtained. As regards plant cultivation the greatest possib-

e is taken to prevent and control plant diseases. The horticultural ›ducts therefore are the result of infinite care and work and, in w of the density of the population of Holland, must be considered of great importance to the Country.

Though these products are very extensively used for home con-nption, their exportation is also of great importance.

Exportation fell off considerably in 1923 owing to the fact that rmany at that time bought less. The extent of this decrease shown by the fact that during the first 8 months of 1924, when rmany again appeared on the market, the value of the exportation fresh vegetables was Fl 11,880,000 as against Fl. 32,260,000 for the rresponding period of 1923. The values of the exportation of sh fruit during the same periods were respectively Fl. 2,593,000 id Fl. 6,486,000. The total value of the exportations during this riod therefore is, in the case of vegetables 272 %, and in the case fruit 242 % of that for the same period in 1923.

During the unfavourable year 1923 the export value of horti-ıltural products was:

	Fl.
fresh vegetables	18,595,000
fresh fruit	5,085,000
flower bulbs	26,383,000
cut flowers and stems	534,000
hot-house products	4,525,000
Total	55,122,000

Importance of Foreign Countries to Dutch Agriculture

Foreign countries are of varying importance to Dutch agri-culture.

Dutch agriculture draws its supplies of raw material in the orm of chemical fertilisers and cattle-feeds from abroad. The mportance of these supplies may be gathered from the following tables:

Importation of Chemical Fertilisers in 1923.

	Weight in tons	Value in [illegible] of florins
Nitrate of soda	151,128	[illegible]
Nitrate of lime	2,[illegible]	[illegible]
Cyanamide	4,685	[illegible]
Sulphate of ammonia	21,354	[illegible]
Kainite	125,397	[illegible]
Potash	31,601	[illegible]
Potash salts	221,105	[illegible]
Superphosphate	80,869	[illegible]
Basic slag	288,417	[illegible]
Rock phosphate	223,266	[illegible]
Other fertilisers	27,234	[illegible]
Total	1,177,851	52,541

Over-seas Importation of Cattle Feeds in 1923.

	Value in thousands of florins
Maize	66,5
Rye	11,0
Barley	23,1
Oats	3,7
Legumes	3,1
Cake and meal	63,8
Other cattle feeds	0,4
Total	163,6

In 1923 therefore as much as 216 million florins' worth of the two important raw materials were imported for Dutch agriculture.

A large proportion of the agricultural machines were also im[illegible] ported, viz., in 1923, to the value of Fl. 2,743,000 and in [illegible] Fl. 3,944,000.

As a set-off against the importation of raw materials and [illegible] cultural machinery stands the exportation of the products of [illegible] culture, stock-breeding and horticulture, which have already been dealt with in various parts of this report.

The following table gives the export value of the chief of these ducts :

Exportation of Agricultural Produce.

	Million florins	Million florins
stock	18,412	
. fats and by-products.	71,685	
and milk-products	144,028	
:	9,465	
Total animal products . . .		243,590
ls and flour	15,818	
ımes	15,946	
and other seed	12,821	
ıtoes	14,098	
ch, dextrine, etc.	16,263	
ır beets and by-products	8,638	
ır	18,167	
. . . .	6,613	
and straw	2,195	
.w cardboard and straw hats.	18,851	
Total field products . . .		129,420
sh vegetables	18,595	
served vegetables	2,741	
sh fruit	5,085	
served fruit	2,521	
wer bulbs	26,383	
flowers	534	
rsery plants	4,525	
Total horticultural products . . .		60,384
Timber . . .		2,000
Total value . . .		435,394

Hence in 1923, the value of the exports of the principal agri-ltural products was Fl. 435 millions.

It should also be borne in mind, as has already been pointed ıt in the case of horticulture, that 1923 was an unfavourable year. his is shown by the fact that during the first 8 months of 1924 the portation of animal products alone was Fl. 242,404,000, or 165 % of ıat for the corresponding period of 1923.

Foreign countries are so important from the point of view of the ıportation of raw materials and the exportation of agricultural

produce, that it naturally follows that where the world market con-
trols prices, an enormous influence is exercised abroad on
agricultural finance; so much is this the case that the prosper-
failure of one of the chief sources of national prosperity such as
culture, is to a great extent dependent on world conditions.

IMPORTANCE OF AGRICULTURE TO THE GENERAL WELFARE OF THE NATION.

From the above figures relating to importation and export it has already been shown that agriculture is of great importance the public welfare in Holland.

This fact becomes still clearer when the large number of p engaged in agriculture and the annual value of agricultural pr are taken into consideration.

The figures in the employment returns for 1920 confirm the point.

According to this return, in 1920 the number of indepen persons engaged in agriculture was 222,000, and of those engag paid labour, 404,000, a total of 626,000.

As, according to this return, the total of employers and empl throughout the country was 2,503,000, it may be deduced tha of the population find a direct means of subsistence in agricul

And as a part of the trade, industry and transport of the Cou is closely connected with agriculture, it naturally follows that indirect importance of agriculture is considerably greater.

The annual value of agricultural production may estimated at:

	Millions of florins
field products	266.3
livestock products	331.1
milk products	268.4
garden products	127.2
forest products	8.0
Total	1031

The figures in the above estimate are based on the prices in 1923, which were above the normal.

Owing to the very dense population of the country, Dutch soil supply the needs of only half the number of inhabitants. By areful selection of crops and intelligent and continuous work, ever, the value of the yield by the land available makes it possible uy, from cereal-producing countries, a quantity of food-stuffs which ould be quite impossible for the soil alone to provide.

Thus, indirectly, agriculture has been made to contribute in the iest degree possible to the general welfare of the Country.

Dr. J. J. L. VAN RIJN,

Report from the Dutch Government, transmitted to the International Institute of Agriculture by DR. J. J. L. VAN RIJN, *Delegate of the Netherlands and Dutch Indies.*

INTERNATIONAL ASSOCIATIONS

PROCEEDINGS OF THE INTERNATIONAL SOCIETY OF SOIL SCIENCE

Papers.

BROWN EARTH IN FINLAND.

According to RAMANN, the principal soil formation of Cent Europe is composed of brown earths, which cover part of Engla almost the whole of France, Germany, Austria, part of Denma South Sweden, Northern and Central Italy. According to RAMA brown earths form in temperate climates and are related to the grow of deciduous trees (1). Brown earths are characterised by a d dark-brown colour, caused by the presence of iron oxide and hum matter. RAMANN assumes that the influence of the bed-rock of special importance as regards brown earths.

According to RAMANN, brown earths do not contain alka the soluble salts, including carbonates and sulphates, having be washed out. On the other hand, iron and aluminium oxides a phosphoric acid are not washed out, or only to a slight extent.

Although it may be admitted that RAMANN's theory as to t extension of brown earths is exaggerated, yet it is certain that brow earths play an important part in Central Europe from the poi of view of soil science. And yet there is no exact description in th literature on the subject of this important soil type, especially regards the central parts of the brown earth zone.

(1) E. RAMANN. Bodenkunde, pp. 533 and 585

The only exact explanation of the existence of brown earth is
1 by KARL LUNDBLAD (1), who describes the brown earth of
ö, Småland, Sweden. In this region are mostly beech forests
typical brown earth formation, as well as needle-leaf forests,
in moss, with normal podsol. The soil section is as follows :

0-3 cm. Forest litter, beech leaves ;
3-15 " Very loose soil of granular structure, containing many earthworms ; the soil changes to a
15-55 " Brown earth, of granular structure ;
55- " C- layer, moraine.

TABLE I. — *Moraine section, Helgö, Sweden* (2).

Brown earth.

rizon	Weight percentage in air-dried soils			Weight percentage in mineral substances		
	A	B	C	A	B	C
1 in . .	3–13	15–32	100–115	3–13	15–32	100–115
. .	65.42	79.99	72.90	76.18	74.69	75.18
. . .	0.53	0.59	0.55	0.61	0.63	0.57
. .	19.97	11.97	12.25	12.60	12.77	12.65
3 . .	2.51	3.31	3.18	2.88	3.53	3.28
. . .	1.98	1.41	1.84	1.82	1.51	1.90
. . .	0.09	0.12	0.15	0.10	0.13	0.16
. . .	2.77	3.19	3.16	3.18	3.41	3.26
. .	3.16	3.12	2.88	3.63	3.33	2.98
. . .	2.49	1.95	1.17	—	—	—
us. .	9.96	3.96	1.98	—	—	—
	99.21	99.62	99.18	100.00	100.00	100.00

The results of this analysis show that aluminium oxide and pot-
are similar in amount and silicic acid and sodium are increased
the A level, whereas iron oxide is washed out of the upper layer.
most important fact is that the humus is of a crumbly texture
1 is therefore very loose.

According to Dr. OLAF TAMM, who in the summer of 1923 de-
nstrated before some soil scientists the occurrence of brown earth,

(1) KARL LUNDBLAD. Ett bidrag till kännedom om brunjords- eller mulljordstypens
-kaper och degeneration i Södra Sverge. *Medelanden fran Statens Skogsförsoksanstalt*,
21, No. 1, 1924.

(2) KARL LUNDBERG. Op. cit.

this brown earth changes very quickly if beech forest is repla[illegible] needle-leaf forest. It must therefore be assumed that the form[illegible] of brown earth originates from the large quantities of fallen [illegible] leaves. Under the influence of the needle-leaf forest the brown [illegible] quickly changes to podsol.

As is known, large deciduous trees are very seldom fou[illegible] Finland. The only "tree" which yields an abundant fall of l[illegible] is the hazel (*Corylus avellana*). It might be supposed that t[illegible] perhaps the cause of the soil formation of brown earth. Hazel-[illegible] however are seldom found in Finland in forest plantations. Neve[illegible] less there is one such instance, the Parish of Laitila in South-[illegible] Finland, where hazels are grown over an area of some hectares. [illegible] soil type is moraine, which has originated from Rapakiwi gra[illegible] A correspondingly typical brown earth formation has taken plac[illegible] this soil type.

Section :

0-7 cm.	a dark-coloured loose layer of granular texture rich in humus (A-layer)
7-17 "	dirty-brown humus (B_1-layer) ;
17-40 "	grey-brown, containing humus (B_2-layer) ;
40 "	moraine (C-layer).

There is no light-coloured earth.

TABLE II. — *Moraine section, Laitila, S. W. Finland.*

Soil horizon	Weight percentage in air-dried soils				Weight percentage in mi[illegible]		
	A	B_1	B_2	C	A	B_1	B_2
Depth in cm.	0–7	7–13	20–30	50–60	0–7	7–13	20–[illegible]
SiO_2	57.25	66.55	70.70	70.95	72.52	74.54	[illegible]
Al_2O_3 . . .	9.76	15.50	11.82	11.93	12.36	11.83	[illegible]
Fe_2O_3 . . .	3.83	3.91	3.75	4.95	4.86	[illegible]	[illegible]
CaO	2.18	1.70	2.16	1.80	2.76	[illegible]	[illegible]
MgO	0.86	1.27	1.13	1.08	[illegible]	1.42	[illegible]
K_2O	2.68	2.46	2.15	3.82	[illegible]	[illegible]	[illegible]
Na_2O	1.66	2.65	2.80	[illegible]	[illegible]	[illegible]	[illegible]
P_2O_5	0.31	0.18	0.28	0.22	0.47	[illegible]	[illegible]
SO_3	0.65	—	—	—	[illegible]	—	—
H_2O	10.33	5.02	2.15	[illegible]	—	—	—
Humus . . .	[illegible]	[illegible]	[illegible]	0.41	—	—	—
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

From this analysis it is evident that the soil formation differs from oil: the sesquioxides are not increased in the B-layer, Al_2O_3 is t the same in weight and Fe_2O_3 is washed out. Potash, phosphoric and especially lime are increased in the A-layer which con- humus. The high humus content in the B-layer causes the rn-grey colour.

As is known, the solubility of humus is an important factor moist regions. The soluble humus matter protects the decom- d substances, which are in a colloidal state, and favours their lacement. The soluble humus matter predominates, especially hose moist regions where the soil type is poor in double bases, in those where the granite bedrock is extensive (podsol district). the other hand the humus matter, that occurring in chernos for ance, is very slightly soluble in water, according to P. KASSO- z (1) about 0.02 to 0.05 %.

The solubility of humus matter in water. — 10 gm. of earth e shaken up with 100 cc. of water and the soluble humus matter tained therein was estimated by means of potassium permangan- solution :

TABLE III.

					% of humus content	% of humus soluble in water, out of total humus
rn earth,	Helgö.	Sweden,	A	layer.	9.69	0.85
»	Helgö.	»	B	»	3.96	1.05
»	Laitila,	Finland,	A	»	10.51	0.79
»	Laitila,	»	B	»	5.49	0.78
podsol,	Heinjärvi,	»	B	»	7.28	1.55
»	Karjalohja,	»	A	»	9.02	2.05
»	Karjalohja,	»	B	»	2.18	0.94
ius podsol,	Heinjärvi,	»	B	»	3.17	7.03
»	Tikkurilla,	»	A	»	41.87	1.47
»	Tikkurilla,	»	B	»	2.41	6.83

From this table it is evident that humus matter, especially the B-layer is least soluble in water in brown earths, and most uble in water in humus podsols. The iron podsols come near brown earths in this respect.

In the above table the soluble humus is expressed in % of total

(1) P. KASSOWITZ. Die Schwarzerde. *Int. Mitteilungen für Bodenkunde*, 1912, p. 323.

humus. But it is important in soil science to know the soil concentration as regards humus. In the following table the of soluble humus per litre are shown :

TABLE IV.

					Humus per litre
					gm.
Brown earth,	Helgö,	Sweden,	A	layer	[illegible]
»	Helgö,	»	B	»	[illegible]
»	Laitila,	Finland,	A	»	[illegible]
»	Laitila,	»	B	»	[illegible]
Iron podsol,	Heinjärvi,	»	B	»	[illegible]
»	Karjalohja,	»	A	»	[illegible]
»	Karjalohja,	»	B	»	[illegible]
Humus podsol,	Tikkurilla,	»	A	»	[illegible]
»	Tikkurilla,	»	B	»	[illegible]
»	Heinjärvi,	»	B	»	[illegible]

The humus matter occurring in brown earths especially, th also in iron podsols, is very slightly soluble in water and forms solutions. On the contrary that in humus podsol dissolves more ea

These examples show the importance of humus matter in formation. In similar conditions, that is when climate and bed are similar, humus podsol with well-formed light-coloured layers, is found under the crude humus, because the humus ma dissolves easily in water, on the contrary iron podsols and br earths form if the humus matter is less soluble in water.

The formation of brown earths is in these cases dependent the vegetation, for the influence of climate and bedrock would a podsol formation. Through the abundant leaf-fall the lime c tent especially, is increased in the upper layer (cf. table II), flocculates the humus matter, changing it into a very slightly sol type. In this case the humus matter does not favour washing and there is no layer of light coloured earth. Owing to the abund formation of humus the upper soil levels are rich in humus ma yet this exerts no protecting influence. Through the presence humus the colour of the upper soil layers is a dirty-brown

No observations have been taken as to the yearly leaf and seed fall in northern countries. The variations in Bavaria, however, cording to EBERMAYER, are not very great in beech planta

kg., in spruce plantations 3500 kg. and in common pine plantations 3700 kg. per hectare. In young plantations, with the exception of pines, the total is generally somewhat higher.

TABLE V. — *Amount of air-dried leaf- and needle-fall per hectare per annum* (1).

No. of observation posts	Age (years)	Proportion of mixed timber	Average yield in kg. per ha.
eech plantations 11	27–56	Beech only, and with oak, birch and aspen.	4182
» » 7	60–85	Beech only, and with oak, birch and pine	4094
» » 7	91–130	Beech only, and with oak, spruce and pine	4044
pruce plantations 12	34–59	Spruce only, and with fir, maple and larch	3964
» 9	60–86	Spruce only, and with fir, beech and maple.	3376
» 10	94–125	Spruce only, and with fir, and maple	3273
ine plantations 10	25–48	Pine only, and with spruce and larch	3397
» » 6	61–74	Pine with beech, spruce and oak	3491
» » 5	80–107	Pine with beech, spruce and oak	4229

The variations in the quantity of potash and lime are con-erable.

TABLE VI. — *Total potash in forest litter..*

	1000 parts of dry matter contain (in gms.)				
	K_2O	CaO	MgO	P_2O_5	Total potash
ech-leaf litter (1)	2.97	24.62	3.64	3.14	55.76
ruce-needle litter (1).	1.61	20.27	2.32	2.14	5.27
ne-needle litter (1).	1.52	3.95	1.51	1.16	14.65
rious forest mosses	7.61	5.47	2.51	4.78	30.98
llowed hazel-leaves (2). . . .	12.37	32.17	4.95	5.90	—
llowed beech-leaves (2) . . .	9.42	18.49	5.06	1.78	—
cayed oak-leaves (2)	4.99	33.70	4.16	3.59	—
cayed birch-leaves (2)	7.25	33.27	3.28	2.09	—

(1) EBERMAYER. Op. c., p. 108.
(2) E. RAMANN: Wanderung der Mineralstoffe beim herbstlichen Absterben der Blätter. *rs. Stat.* 76, pp. 157-160, 1912.

(1) E. EBERMAYER. Lehre der Waldstreu, pp. 44-49, Berlin, 1876.

If, according to EBERMAYER, the potash content per year hectare of the annual yield of completely dry litter be determ the following mineral nutrient substance content of the upper layer, in kg. per ha, is obtained :

	Dry litter per year	Total potash	K_2O	CaO	M[illegible]	[illegible]
Beech-leaf litter	3331	185.54	9.89	82.01	12.1[illegible]	[illegible]
Spruce-needle litter.	3007	135.92	4.84	60.95	[illegible]	[illegible]
Pine-needle litter.	3186	46.52	4.84	18.96	4.[illegible]1	[illegible]

The lime content of the beech-leaf and spruce-needle litter considerable in comparison with that of the pine-needle litter. in addition to this, it be borne in mind that the very resinous spr and pine-needles take much longer to rot than the leaf-litter, will become clear that leaf-litter favours the formation of the m coagulated humus.

This kind of humus is formed principally in dry places; areas where the water level is high, the lime is washed out, where the solubility of the humus matter is increased.

The brown earth formation occurs in Finland only in certa places and forms flats of small extent. It should also be observ that these soil formations, which lie outside the true brown-ear zone, differ to some extent from the brown earths of the centr parts of the zone. For instance, according to STREMME (1) th German brown earths at the boundary of the subsoil are character ed by concretions of calcium carbonate ; this phenomenon does n take place at all in the brown earth formation of Finland. If th general character of these soils be taken into consideration howev the last-named must be classed before the sesquioxide soils (2

The brown earths in Finland, differ from the podsols by the a sence of light-coloured earth and the fact that their humus matt is less soluble in water. A low sesquioxide content and slight d ference as regards bedrock is common to both these soils.

B. AARN[illegible]

(1) H. STREMME. Bodentypen in Deutschland, *Mémoires sur la nomenclature et la clas-sification des sols*, p. 2, Helsingfors, 1924.

(2) B. AARNIO and H. STREMME. Zur Frage der Bodenbildung und Bodenklassifika-tion. *Mémoires sur la nomenclature* etc., p. 73.

Abstracts and Literature.

eral.

Bases of Petrography.

ERDMANNSDOERFFER, O., *Grundlagen der Petrographie*, pp. 321, illust. 119. by Ferd. Enke, Stuttgart, 1924.

The author shows the connection between the geological, physico-
ical and mechanical bases of the science of petrography. In this
the geologist is shown the direct application of general knowledge to
problems which specially interest him, and the mineralogist, whose
ition is directed more towards the physical and chemical branches of
ce, the application of the results of his researches on the processes in
great laboratory of Nature.

After a general introduction, the separate chapters deal with: the
sphere, the glacial rocks, magnetic conditions, the period of formation
e magma, the structure, texture and sectional formation of the glacial
s, the causes of metamorphism and its products in their geological re-
ns. The separate chapters are accompanied by detailed references to
literature on the subject.

This important work of ERDMANNSDOERFFER is in every respect one of
best from a scientific point of view. SCHUCHT.

Ianual of Mineralogy.

GOSSNER, Dr. B., with a portrait of G. AGRICOLA, *Lehrbuch der Mineralogie.* lates and 465 text illustrations. Publ. by Fr. Brandstaetter, Leipzig.

The present work is in a certain sense the successor of that by F. v.
BELL, from which a number of the figures in the text are taken. It
ild serve as an instructive manual, condensed, but at the same time
complete as possible, in order to give a comprehensive view of the many
nches of mineralogy and should be especially useful to students of
mistry, geology, natural science and mining.

This excellent work, of a high scientific type, is divided into two prin-
al parts: I. General mineralogy; II. The system, formation and
urrence of minerals (special mineralogy). These two parts are subdivided
follows:

Part I.: Mineral physics (the form of crystals — formation and
sappearance of crystals — cohesion — crystals and their radiant-energy
structure — the crystallographic phenomena of certain minerals). The
mistry of minerals (the general composition of minerals — the chemical
es of mineral formation). Minerals from a geological point of view
neral causes of the existence of mineral stratification — system of min-
l stratification).

Part II. : Silicates — oxides (including hydroxides) and ... pounds — mineral sulphides — mineral salt compounds of the ... acids. Appendix : Rare or unclassified substances.

Soil Science for Farmers and Foresters.

MITSCHERLICH, Dr. EILH. ALFR., *Bodenkunde für Land- und ...* 4th Edition (revised, with 37 text illust. Publ. P. Parey, Berlin, ...

The new edition treats of recent research and knowledge in the ... physiology branch of soil science.

MITSCHERLICH's " Soil Science " is so well known that any ... recommendation is unnecessary.

A Manual on Geology.

KOBER, Prof. Dr. LEOP., *Lehrbuch der Geologie.* Illust. 325, maps ... 30 plates. Publ. by Hoelder, Pichler, Tempsky & Co., Vienna, 1924.

Contents : Biology as a Science — Review of the history of the ... mation of the earth — General structure of terrestrial bodies — ... of the earth's crust — Stratification of the rocks — Volcanic phenomena ... Climatic zones of the earth and their geological importance — The ... of water and air — The activity of organisms — Movement of the earth's crust — The geosynclinal zones and glacial continental masses — ... most important groups of fossil plants and animals — Structure of ... earth — General laws and theories — Treasures of the soil — Geolog... palaeontological-atlas-index.

A book to be recommended.

A Petrographic " Vademecum ".

WEINSCHENK. *Ein Hilfsbuch für Geologen, Geographen und ...* (An Aid to Geologists, Geographers and Technologists). Revised by ... STINY. IV. Edition (revised) 256 pp., 1 Plate, 104 text illustrations. Publ. Herder & Co., Ltd., Freiburg im Br., 1924.

WEINSCHENK's well-known book, which constitutes a " Petrography without a Microscope " has been further improved by its reviser in accordance with the progress of science, and can be strongly recommended to all soil scientists on their expeditions into the mountains.

A General Chart of the occurrence of Potassic Salts and Petroleum in Germany.

Übersichtskarte der Deutschen Kalisalz- und Erdöl... 1 : 450 000. Published by the " Preuss. Geolog. Landesanstalt " (Prussian National Geological Institute) compiled by ERNST FULDA, Member of ... Mining Council (" Bergrat "), Gea-Booksellers, Ltd., Berlin W. ...

The new potash chart includes those parts of the Provinces of Han... Saxony, Hesse-Nassau and the territories lying between them ...

sic salts are extracted. It includes not only geological data, but also connected with mining, such as potash mines, potash works, salt s, the mining-district boundaries, etc. and is completed by explanatory . The chart is excellent, both on account of the clear colouring and rehensive contents, and can therefore be highly recommended.

SCH.

ysical Properties of Soils.

ence of Water on Soil Granulation.

BOUYOUCOS G. J. (Michigan Agricultural Experiment Station). *Soil nce*, Vol. XVIII, No. 2, pp. 103-110, 1 table. Baltimore, Md., 1924.

One of the most interesting physical phenomena in the soil is its istent tendancy to assume a granular form when exposed to certain processes connected with the weather, such as the alternation of sture and dryness. The natural soils of the fine texture type have ost always this granular type, which is so necessary for plant growth. when the soil is liable to caking, becoming dense and hard, it begins rumble if subjected to alternate moisture and dryness. It is generally agreed that the granulation is due to the force of contraction of pellicles of water in the soil. When the soil moisture begins to diish by evaporation, the power of contraction of the pellicles of er increases, the pellicles becoming finer and finer, causing the soil ticles to become attracted one to another, the soil thus becoming culated. This theory however is not correct, for otherwise the soil would d to contract more and more into a dense mass, and there would no ger be any granular structure. Soil granulation on the contrary ans not only the flocculation of the particles into larger ones, but also crumbling of dense masses into others of loose structure.

Water participates in the process by detaching the particles from one other, being enabled to do this through the swelling of the colloids l by decreasing the cohesive power of the particles. Thus the clods uire a granular structure. The force of contraction on the other nd is due not to the water pellicles, but to the cohesive power of soil itself.

A. F.

e Effect of Movement of Soil Salts on the Standardization Values of Electrodes used in Soil Moisture Determinations.

DEIGHTON T., *Journal of Agricultural Science* 13, 440, 1923.

Aims at determining to what extent the movement of soil salts affects ctrode standardization values in a method for determination of soil isture previously described. Fairly light soil packed in a large box, with nstant water table, is presumed to have moisture content dependant on mperature and relative humidity of air at surface only. Units of 3 ectrodes were sunk at 3 ", 4 " and 6 " depths ; 3 resistance thermometers

were used at the same levels. Fluctuations of resistance were ... (i) while the system was coming to an equilibrium ; (ii) after appli... of varying quantities of "Artificial rain" applied at surface. Con... were reached to the effect that at 3", or at a lower depth relative ... exerts no effect, nor did 1 mm. of rain affect these levels.

Several of the results were erratic, but the evidence available se... to show that on normal soils small rainfalls would not materially ... standardization values. T.

The Soil Point Method for directly Estimating the Water Supp... Power of a Soil in the Field.

HARDY, F. *Journal of Agricultural Science*, 13, 365, 1923.

Develops under field conditions MASON's laboratory investigati... the same subject *i. e.*, the use of the conical surface of sharpened high ... graphite writing pencils for the absorption of moisture in the soil ... pencils in lots of ten constitute one trial. The depth of absorbing su... below ground is 5"; time 3 hours. The probable errors quoted are insi... cantly small. The following figures refer to the water supplying cap... of the soil at drying point in terms of hundredths of a gram of water ... sorbed by one soil-point in the specified time : MASON 1.41 = 0.031, HA... 1.71 = 0.066. T ...

The Maximum Water Retaining Capacity of Colloidal Soils, etc.

HARDY, F. *Journ. of Agricultural Science*, 13, 340, 1923.

The soils dealt with are representative of the diverse geological ty... of the British West Indies. Investigations were made chiefly with res... to their behaviour in the light of (i) The Briggs-Shantz formula for M... inum Water Retaining Capacity, M = 4.3 H + 21 ; (ii) a formula M... P + 23.5 (P = % moisture when in a plastic state) derived from W... DON's theoretical considerations. Data are given showing that the BRI... SHANTZ formula holds for soils without highly marked colloidal proper... but the experimental values are in excess of those calculated for soils ... high siliceous colloid content. Such soils swell during imbibition and ... soil mass is loosened with consequent increase of pore space.

Red laterite soils show the opposite effect, as their colloidal mate... is mainly alumina and ferric oxide hydrogel ; their volume expansion is l... Humus soils have a high volume expansion and resemble siliceous coll... al soils in the nature of their deviation from the BRIGGS-SHANTZ form...

WILSDON's "Vesicular coefficient" $\frac{P}{H}$; theoretically estimated ... 4.3, varies from 4.9 to 3.3 for the first class of soils and from 3 ... only for the second. This is believed to account for low experiment... values for the BRIGGS-SHANTZ formula in the laterite soils. The sec... formula is approximately correct for laterite soils but is not suitable ...

other types. The reliability of the drying coefficient and critical moist- content formulae is examined in the light of the data and conclusions n. T. E.

Moisture Investigations in Canada.

Hopkins, E. S. (Central Experimental Farm, Ottawa). *Scientific Agriculture*, V, No. 3, pp. 79-83. Ottawa, 1924.

An outstanding fact of Canadian agriculture is the wide variations ch occur from year to year in the yield of wheat grown in the Prairies vinces. In Alberta the yield has ranged from 6.0 bushels per acre in 3 to 32.7 in 1915 ; in Saskatchewan from 8.5 to 28.5, whereas in Onta- the extremes have only been from 12.5 to 23.2 bushels.

The average yields per acre for the past 23 years for wheat exporting ntries (Russia 15 years) are as follows : Canada 17.8 bushels, United tes 14.1, India 11.3. Australia 10.6 Russia, 9.4.

Poor yields are due partly to rust, but the most important cause is ught.

The Dominion Experiment Farms have shown that timothy, red ver and alsike do not succeed on the prairie ; western rye and brome ss are more drought resistant. The summer fallow may be replaced maize, which in addition to giving a crop leaves the land in good condi- n for wheat and the stubble prevents the dry soil from blowing away.

At the Swift Current Station it has been shown that for the years 1-1922 it has taken 1221 lb. of water (including transpiration and evap- tion) to produce 1 lb. of wheat grain, on which basis 6.5 inches of water uld be required to produce a 20 bushel crop. Rainfall appears to have most beneficial effect about the time of heading. It has been proved that soil mulch is not sufficient to conserve soil moisture. Weeds are the at enemy, not only as regards soil nutriment but also of moisture.

A study of statistics indicates that the hay crop varies the most, oats next and maize and silage the least. Experiments are being carried t to ascertain which rotation is most economical in its use of soil moisture, by the inclusion of different types of crops a certain amount of safety y be obtained in years when the rainfall is deficient. W. S. G.

e Moisture Equivalent of Heavy Soils.

Joseph, A. F., and Martin, F. J. *Journ. of Agricult. Science*, 13, 49, 1923.

Moisture equivalent is defined as the percentage of moisture retained by e soil after draining centrifugally for 40 minutes by a force of 1000 times at of gravity. Results showed that increased thicknesses of soils the perforated boxes decreased the moisture equivalent by increasing e density of the lower layers and reducing pore space. With certain avy soils, closely compressed, impermeability causes accumulation of ter in surface layers and consequent increase in moisture equivalent. ay content is not the only factor ; the water logged soils were those of

higher P_H value. Salt content caused variations of the moisture equi-valent which was increased by deflocculating agents such as sodium car-bonate, and decreased by flocculating. salts.

Sodium carbonate gave a distinctive curve for the moisture equ— Na_2CO_3 concentration relationship. Moisture equivalent reaches max-imum value at a concentration of 2% and then falls off. Varia the content of colloidal clay produced variations in moisture equi but of small degree. No such effect was noticed with other colloids as kaolin.

T

The Form of Mechanical Composition Curves of Soils, Clays and Granular Substances.

ROBINSON, G. W. (University College of North Wales) *Journal of Agri-cultural Science*, Vol. XIV, Part. 4, pp. 627-633, figs. 2, bibliography. Lo 1924.

The article describes the results obtained of the mechanical ana of a large number of soils, clays and other granular materials, carrie by the author's thod. The re are set out in form of curves sh ing the relation between summ percentages and l rithm of settling locity. The curves smooth, which cates that a com ratively small n ber of determinati are sufficient to racterise the mec nical composition a soil or clay.

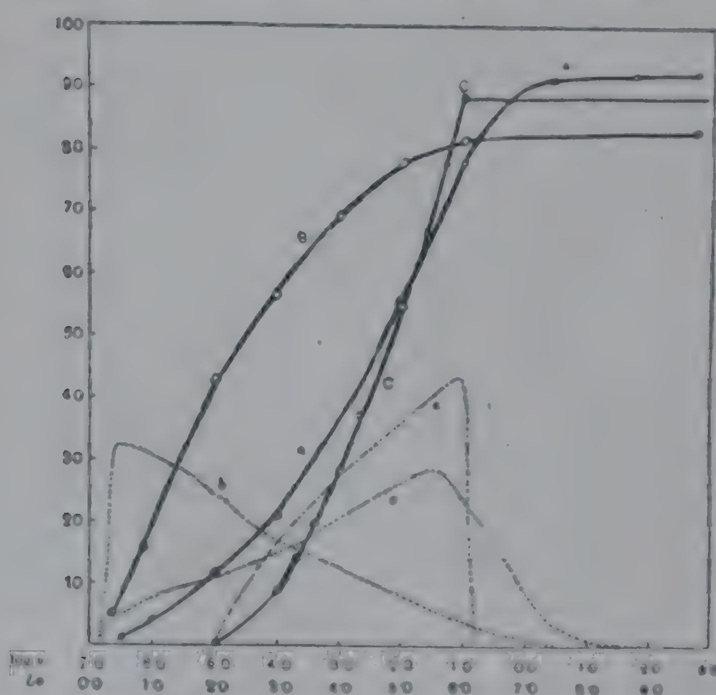

FIG. 87. — Principal types of curves illustrating the mechan-ical composition of soils.

The curves ordinary soils, clays are found show one gen type and two types, illustrated Fig. 87.

The most common type of curve, to which the great majority soils belong, is the sigmoid, as exemplified by curve A. The steep portion represents the fraction present in greatest frequency, this termed by the author the *modal fraction*. Two variants of the main ty of curve were encountered, one in the case of very heavy clays, as sho by curves B and *b*, in which the lower portion of the sigmoid appears be supressed, so that the modal fraction falls to the lower limit.

n the case of certain materials which have been reduced to pow- y grinding, as for example slate powder, represented by curves C ;, the modal fraction appears to be at the upper limit.

The lower limit of particle size appears to be represented by log. v 0000 in the case of normal soils and clays.

In the case of kaolin and certain finely divided but non-plastic ma- ls, the lower limit appears to be in the region of $\bar{5}.0000$. The author sts that the properties of soils would be better shown by taking imit for clay at this point instead of at log. $v = \bar{4}.0000$; if this were ed then the difference would be more clearly shown between plastic tances and materials which, although in a fine state of division, have the characteristic properties of clay.

The use of the logarithm of settling velocity as a measure of part- size is discussed and it is suggested that the use of negative logarithms it be avoided by using log $(v + 10^7)$, for which the symbol L v is pro- d.

W. S. G.

emical Properties of Soils.

Determination of Ammonia in Soil.

BENGTSSON N. (Central Agricultural Experiment Station, Stockholm). *Science*, Vol. XVIII, No. 4, pp. 225-268, bibliography. Baltimore, Md., 4.

The author has revised the methods hitherto employed for the de- mination of ammonia in soil and has found that with none of them the whole of the added ammonia be recovered.

The test showed that it is impossible to carry off all the ammonia in oil extract. It is therefore necessary to adopt the method of successive racts proposed by the author. For this purpose 25 grams of soil are racted successively with 7 portions of 100 cc. of a solution of 4 % oride of potassium. For peaty soils, on the other hand, portions 50 cc. are be used. The method is not suitable for clay subsoils taken a depth of 25-35 cm.

A. F.

ular and Seasonal Changes in the Soil Solution.

BURD J. S. and MARTIN J. C. (University of California Experiment Sta- n). *Soil Science*, Vol. XVIII, No. 2, pp. 151-167, bibl. Baltimore Md., 1924.

Crops continued for a long period constantly diminish the concen- tion of soil solutions, which are obtained by the displacement of wa- . By leaving the soil fallow, on the other hand, the concentration such solutions is increased, except in soils in a state of high fertility.

In soils cultivated continually for some years the seasonal decreas- of concentration are only temporary, while such concentrations tend to rease in the season following that in which there was a decrease. There also characteristic fluctuations of certain constituents, and the phosph- s essentially depend on the reaction of the solutions.

It is evident that the qualitative composition of the soil undergoes continual changes. It follows that the solutions for water cultures, made to reproduce the conditions of the soil at the beginning of the season, no longer represent the conditions found in the succeeding stages of plant growth. A. F.

The Influence of Hydrogen-ion Concentration and Different Salts on the Electrical Charge of Clay Colloids.

DAYHUFF, W. C. & HOAGLAND, D. R. (College of Agriculture, University of California). *Soil Science*, Vol. XVIII, No. 5, pp. 140-408, bibl. Baltimore, Md., 1924.

It is known that the physical conditions of a soil depend to a great extent on the colloidal state of the clay fraction, and it would be interesting to know how the reaction and electrolyte content of the soil solution might modify the state of the clay dispersion. In such systems, one of the must influential factors is the electric charge of the colloidal particles.

Some years ago ARRHENIUS had advanced the theory that the clay could act as an ampholyte and therefore behave similarly to protein, in accordance with LOEB's idea. The authors' investigations on the contrary have shown that, at least as regards the clay type examined, the colloids possess no definite isoelectric point (unlike protein) in the series of hydrogen-ion concentrations examined (from P 2.1 to 12.7). The colloids continue to remain charged negatively.

On the stability of the colloidal clay suspension, the nature and concentration of the cations, on the contrary, have the greatest influence. It may be that in the soil conditions are somewhat different ; there may be certain organic colloids present, which may behave differently.

The question is important also from the practical point of view. As is known, an alkaline reaction of the soil is not unfavourable to plant growth. This may be due not only to the direct influence on root growth, but also to the influence on the physical state of the soil itself, whereby an unfavourable state for root growth and for the activity of microorganisms is created. The alkaline reaction in fact may cause deflocculation, decreasing the solubility of the di- and tri-valent cations, instead of influencing the hydroxylion concentration. A. F.

The Science of Soil Solutions : Methods for Obtaining and Testing Soil Solutions.

DOJARENKO, A. G., Prof. *Journal fur landwirtschaftliche Wissenschaft* 9-10. State Technical Publishers, Moscow, 1924.

This essay describes the principles and methods for the testing of soil solutions, which are important in agriculture. The author, in collaboration with his colleague A. A. SCHNIWCK, proposes a method for obtaining a solution without diluting with water, for which purpose use is made of the " Petroleum Emulsion method ". The freshly-obtained soil samples of which the water content must be more than double the hygroscopic

water capacity, are well mixed with a certain quantity of a completely neutral and chemically inactive oil (vaseline oil), so that the oil forms an emulsion with the soil solution; from this, by slight pressure and subquent centrifuging, the soil solution, free of oil, is obtained. The following means for testing the soil solution are adopted: osmotic pressure, measurement of conductivity, degree of solubility of the electrolyte, colloid content, refraction exponent, rotatory power, chemical-calorimetric determination, titration of the oxidising compounds with permanganate.

GOERNER.

A Comparison of Qualitative Tests for Soil Acidity.

HARPER, H. J. & JACOBSON, H. G. M. (Iowa Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 2, pp. 75-85, bibl. Baltimore, Md., 1924.

The different methods of testing enable very acid soils to be distinguished from medium and slightly acid soils. The Soiltex method also distinguishes neutral and basic soils, and has the additional advantage of requiring but few appliances; but with peat and clay soils the solutions obtained are not sufficiently clear. TRUOG's test requires more appliances and a longer time than the others; this method and COMBER's potassium salicilate test give accurate results with moist soils. The Iowa method gives good results with soils containing 20 % moisture, and RICHOPOOR's only with dry soils.

A. F.

On the Determination of the Influence of Soil " Buffer-Action ".

JENSEN TOVBORG S. (Statens Forsogsvirksomhed i Plantenkultur). Om Bestemmelse af Jordens Stodpudevirkning. *Tidskrift for Planteavl*, Vol. 30, No. 4, pp. 565-585, figs. 21, bibliography. Copenhagen, 1924.

The author has determined the P_H variations in a soil suspension (10 gm.) in a constant volume of liquid (100 cc.), by adding thereto increasing quantities of hydrochloric acid and calcium hydrate in decinormal solutions. In order to investigate the influence of carbonate of lime on soil reaction, the calcium hydrate added was transformed into carbonate of lime by the addition of carbon dioxide at atmospheric pressure. According to N. BJERRUM and J. K. GIALDBOEK, in a liquid saturated with carbonate of lime, the P_H value may be expressed by the following equation:

$$P_H = 5.02 + \frac{1}{2} \log. C_{Ca}{}^{++} + \frac{1}{2} \log. pCO_2$$

in which $C_{Ca} + +$ is the molecular concentration of the calcium ions and pCO_2 is the pressure of the carbon dioxide in the liquid.

For a liquid saturated with carbonate of lime at the normal pressure of carbon anhydride $P_H = 8.38$. It follows that the extreme limit of P_H in a soil suspension, to which is added increasing quantities of carbonate of lime, is 8.4, provided the soil in question does not contain large

quantities of alkaline, or other strong carbonates. When the transformation mentioned does not take place, the carbon dioxide of the atmosphere will cause a partial transformation of calcium hydrate to carbonate and the P_H will diminish in relation with the pressure of carbon dioxide in the atmosphere.

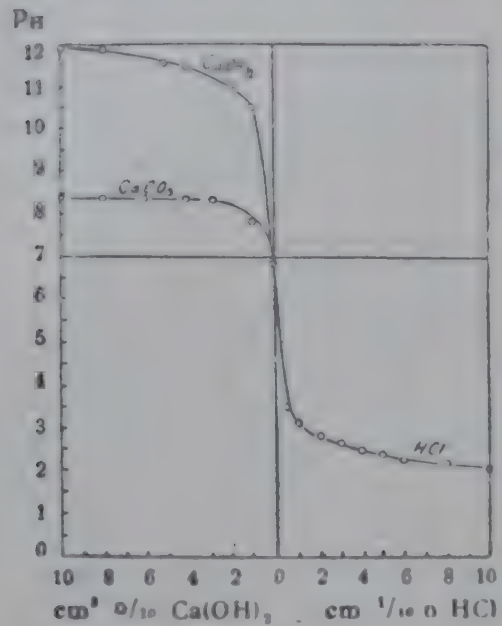

FIG. 88. — Standard curve showing buffer action in quartz sand.

The P_H determination was made in a soil deprived of " buffer action ", formed of pure quartz sand (Fig. 88). The results were expressed in graphs in which the quantities of calcium hydrate and hydrochloric acid added in decinormal solutions are in the ordinates, and the ascertained P_H values in the abscissae. The results obtained with the soils examined were expressed in a similar manner. In the diagram then, if the soils in question have no " buffer action " influence, the lines will coincide, whereas on the other hand, the greater such influence, the greater will be the deviation.

The exact value of the soil " buffer action " influence on the acid in a determined P_H interval, is expressed by the difference in length between distances at which the type curve and that of the soil examined intersect the horizontal lines which represent the same P_H intervals (Figs. 89 and 90). Such

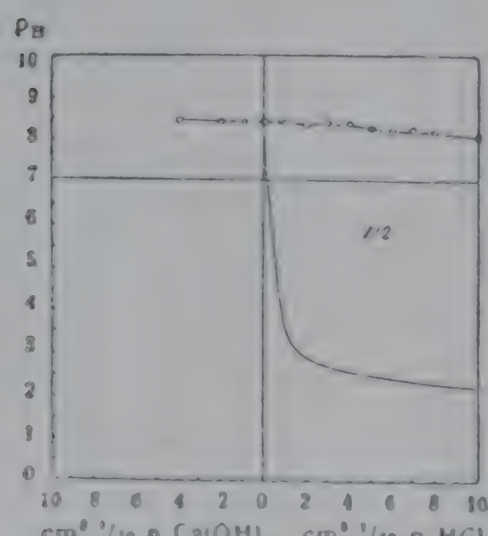

FIG. 89. — Curve showing buffer action of garden soil.

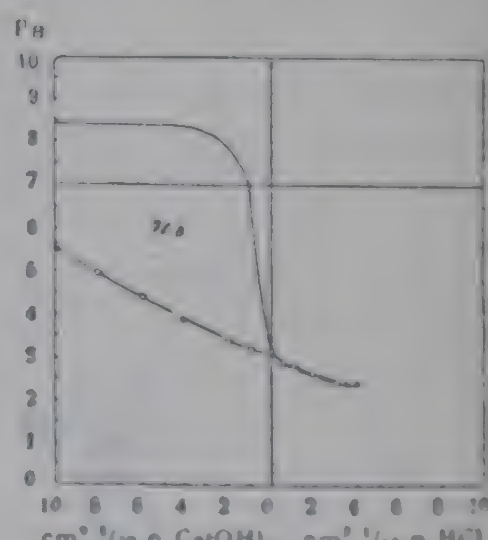

FIG. 90. — Curve showing buffer action of soil from a dry pond.

difference in length shows how many cc. of decinormal hydrochloric acid can be held by 10 gm. of soil, when the P_H values diminish within the limits shown by the interval. A. F.

Alkali Soil Investigation. Chemical and Biological Effects of Treatments.

JOFFE, S. S. and MACLEAN, H. C. (New Jersey Agricultural Experiment Station). Alkali soil investigations : chemical effects of treatment. *Soil Science*, Vol. XVIII, No. 2, pp. 133-149, bibliography.

Id. IV. Chemical and Biological Effects of Treatments. *Ibidem*, No. 3, pp. 237-254, 1 table, bibliography. Baltimore, Md., 1924.

The results of the first series of tests show that treatment with 2000 lb. of sulphur per acre is not sufficient to completely transform the soil alkalis. The total of hydrogen ions from 2000 lbs. of sulphur is not sufficient to substitute the zeolitic cations and neutralise the existing and potential soda. Alum, especially in combination with sulphur, may exert some influence.

It should be borne in mind that the soils examined contain soda and sodium in their zeolitic portion. Now when the colloids are coagulated, the carbonates begin to disappear ; some are changed into bicarbonates, others disappear, as is the case with carbonic anhydride, of which a part is utilised by the microflora. The first reactions take place with the carbonates in so far as they are solution reactions, and these are then followed by replacement reactions.

From the nature of the cations, it will be expected that the first to disappear must be the sodium, followed by calcium. By frequent determinations it is possible to ascertain the moment in which the whole of the sodium has been substituted ; only then is leaching resorted to. The oxidation of the sulphur that follows the leaching, supplies the hydrogen ions for replacement of the calcium which forms gypsum. When all the sulphur has been oxidised and all the hydrogen ions have been exhausted, the reverse reaction takes place, as shown in the following equation, which is reversible :

$$Ca\,Al_2\,Si_x\,O_y\,.\,nH_2O + H_2SO_4 \rightleftarrows H_2\,Al_2Si_x\,O_y\,.\,nH_2O + CaSO_4\,.\,H_2O$$

The quantity of sulphur necessary is probably 4000-6000 lbs per acre.

The combined effects of the sulphur and alum resulting in improvements of alkali soils lead one to conclude that it is possible to use both these products for that purpose. The advantage would be that the alum would immediately coagulate the colloids, and the hydrogen ions of the sulphuric acid would then be utilised for replacement of the sodium. Further investigation is necessary however before defining the practical application of these two agents.

The use of organic substances, such as peat or large quantities of stable manure is effective in so far as they serve as a buffer, they do not, however, contain cations capable of reacting on the zeolitic portion of the

soil. In any case their effectiveness is only temporary, and is perhaps due to the introduction of some substance which serves in plant nutrition.

The authors have also investigated the biological effects of treatment, but the data obtained do not up to the present allow any conclusions to be drawn. In general, the authors' investigations would afford a theoretic basis for the views of GEDROIZ. The practical conclusions might lead to modifications in some particulars, but on the whole it is probable that from the results of these investigations one might proceed to their application. A. F.

Adsorption and Absorption of Bases by Soils.

JONES, C. P. (Massachusetts Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 3, pp. 255-273, 1 fig., tables 8. Baltimore, Md., 1924.

The colloids of the soil may be divided into two great classes: inorganic and organic. Silicic acid, silicates, aluminium hydroxide and its silicic acid and ferric hydroxide compounds belong to the former. Among the organic colloids are the humus compounds and the various species of micro-organisms such as soil bacteria and fungi as well as the mucous matter secreted by such micro-organisms.

The colloids are capable of adsorption and absorption. The former is a surface phenomenon and is not considered to be of great importance, whereas absorption is important. The latter, which might also be called decomposition-adsorption, is a chemico-physical reaction and depends on the chemical nature of the colloids which enter into reaction.

The absorption of the bases by the soil is directly dependent on the degree of hydrolysis of the salt in solution. Hence the laws which govern hydrolysis, *i. e.*, chemical composition of the salt, concentration, and temperature, apply also to absorption.

The absorption of the bases of the compounds, which contain a strongly ionised base and an acid, is small. With the decrease of the ionisation of the base and of the acid there is an increase in the degree of hydrolysis and consequently an increase in the absorption of the base. This, in but slightly soluble substances, follows WENZEL's law: the speed of reaction of the solids with the liquids is proportionate to the air in contact with them.

The absorption of the bases by the soil is due to the chemical reactions between the constituents of the soil and the dissolved salts. Adsorption, or surface attraction, is merely accessory. A. F.

Drying of the Soil and Maintenance of Fertility.

LEEBEDJANTZEV, A. N. (Shatiloff Agricultural Experiment Station). Drying of the Soil as one of the Natural Factors in Maintaining Soil Fertility. *Soil Science*, Vol. XVIII, No. 6, pp. 419-447, tables 24. Baltimore, Md., 1924.

The drying of soil to an air-dried condition in the open air at ordinary temperature, produces a large increase in the yielding capacity in the case of pot experiments.

Especially responsive to drying appear to be uncultivated soils and

those under grass for a number of years ; soils under continuous mechanical cultivation respond less readily. Soils fertilised with farmyard manure or phosphates are more responsive than unfertilised soils. Meadow grasses show the best results with soil drying.

A positive influence of drying is evident only with cultivated soils reaching a 6 per cent content moisture, and with uncultivated soils reaching 14 per cent. With a less amount of drying, fertility is not increased and may even be lowered. Repeated drying of the same sample of soil, with intermediate moistenings, is accompanied by a further increase in the yielding capacity and the maximum fertility is attained with triple drying.

The maximum effect of drying for deep black soil seems to be in the layers 20 to 40 and 40 to 60 cm. For surface soils (0 to 20 cm.) as well as for the layers lower than 60 cm., it is markedly less.

During the process of drying, important chemical changes take place in the soil which tend to increase the solubility of organic substances and to enrich the soil in nitrogen and phosphorus, and to bring about a large increase of ammoniacal nitrogen, a considerable increase of amide nitrogen and a diminution in micro-organisms. These changes are very similar to those taking place in the soil under the influence of low temperatures and antiseptics, so that the drying of a soil may be considered as partial sterilisation. The factors most important for ensuring these effects are dehydration and temperature, while oxygen and light cause a decrease in fertility.

An indirect proof of the favourable action of the drying on fertility is given by the fact that the upper 5 cm. layer is the most fertile and also increases its fertility most rapidly. A. F.

The Influence of Various Salts on Acid Soils.

MIYAKE, K., TAMACHI, I. and KONNO, J. (Institute of Agricultural Chemistry, University of Hokkaido, Sapporo, Japan). The Influence of Phosphate, Biphosphate, Carbonate, Silicate and Sulphate of Calcium, Sodium and Potassium on Plant Growth in Acid Mineral Soils. *Soil Science*, Vol. XVIII, No. 4, pp. 279-310, tables 7, bibl., Baltimore, Md. 1924.

The study of acid mineral soils and the improvements to be made in them is very important for Japan, where such soils are very extensive. The low fertility of these soils is especially due to the presence of large quantities of aluminium, which seem to have a toxic effect on plants.

The authors' experiments have shown that soil acidity may be reduced by the addition of carbonate, phosphate, biphosphate and silicate of lime, soda and potassium, whereas sulphate has no effect. By the addition of such salts, the hydrogen-ion concentration is also reduced, but not to the same extent as the acidity.

The quantity of aluminium which passes into solution with potassium chloride, after the addition of the said salts, corresponds with the acidity, which latter therefore seems due to the quantity of dissolved aluminium.

The salts, arranged in the order of their power to render aluminium insoluble, are the following: carbonates, phosphates, biphosphates and silicates. The sulphates, on the contrary, increase the quantity of soluble aluminium.

In the tests made with barley, the order of beneficial influence is as follows: phosphates, biphosphates, carbonates and silicates, while the unfavourable influence of the sulphates is confirmed. The order is therefore the same as that in which aluminium is rendered insoluble, except that the phosphates and carbonates have exchanged positions. It is deduced therefore that the presence of large quantities of aluminium in acid soils is a very important factor in connection with the low fertility. The greater influence of the phosphates seems to be due to the deficiency of phosphoric anhydride in such soils.

Although hydrogen-ion concentration is also reduced by the addition of the said salts, it was impossible to prove that there was any connection between it and plant growth.

It is therefore concluded that "the inferior quality of an acid soil as regards plant growth is due, at least to a certain extent, to the presence of soluble aluminium, which is decidedly toxic to plants, and to the deficiency of phosphoric anhydride." These chemical products which can give the necessary quantity of phosphoric anhydride and cause the elimination of soluble aluminium are therefore most suitable for such soils. A. F.

Determination of the Hydrogen-ion Concentration of Soils by the Colorimetric Method.

NIKLAS, H. and HOCK, A. *Zeitschrift für angewandte Chemie*, v. 38, p. 1[illegible]. Leipzig, 1919.

The authors describe the principles of the colorimetrical determination of the hydrogen-ion concentration in soils by CLARK and LUBS' test, also by that of MICHAELIS, and show the comparative determinations of the P_H in the soil by these two methods, which agree very well. The authors further compare the colorimetrical P_H determination with the electrometric, in which the slight deviations from the maximum $\pm$ 0.1 P_H show that the use of the colorimetric methods, both according to MICHAELIS and to CLARK and LUBS, fulfil the requirements of scientific exactitude. NIKLAS.

Soil Nitrogen.

RIPPEL, A., Versuche aus dem Nachlass von ALFRED KOCH. *Journal für Landwirtschaft*, No. 1, pp. 17-52. Berlin, 1924.

The fundamental conception of KOCH may be summarised as follows: generally speaking, whereas on fallow land it is possible to adopt practical measures in order to increase the fixation of nitrogen by bacteria, it is necessary at the outset to find fallow land which can supply the required amount of energy to the bacteria to enable them to fix the nitrogen, by the utilisation of the organic matter of the soil, although assisted by adequate soil cultivation.

The author is decidedly against this opinion of KOCH's, and considers that the problem of fallow land is only a part of the larger problem, of the nitrogen cycle and its renewal in cultivated soil.

The author has never found that on fallow land nitrogen is assimilated in appreciable quantities.

The author then gives the results of KOCH's experiments on the cultivation in the open field of wheat, rye and meadow-grass. Parallel tests were made on fallow and on cultivated soil, the plots being 3 metres apart. The fertilisers used were potash salts, Chile nitrate and ammonium sulphate. The resulting wheat crop was larger than that of the rye. The yield of grain was proportionately larger than that of straw.

The proportional decrease in quantity of straw was probably due to the gradual production of nutritive elements by the soil, and especially of nitrogen.

In the case of meadow-grass the variations in yield for the different years of the test are larger than in the case of wheat and rye, which is due to the fact that the hay crop depends more than wheat and rye on the year's precipitations.

The average results of the tests for the four years, however, show that the total hay crop is about the same as that of wheat and rye.

Other tests were made by KOCH in metal cylinders with open bottoms. Here it was observed that in the case of wheat the proportion of grain to straw is about the converse of that observed in the yield from the open field. The fertilisers used in this case were potassium nitrate and potassium phosphate.

Other tests were made regarding the action of nitrogen at different depths of the soil, the object of which was to compare soil weathered during the winter and cultivated during the summer with similar, but unweathered soil. The tests were made in pots, with potash salts and superphosphate. The results show how easily the nitrogenous substances in the upper strata of the soil may be made available.

Other tests by KOCH relate to the effect of sugar, cellulose and straw on the nitrogen content of the soil.

The addition of dextrose and cane sugar, continued for a period of 9 years, caused an increase in yield, which increase then stopped at the end of the period mentioned. As regards the addition of cellulose to the soil (in the form of paper), either alone or mixed with manure, KOCH found that cellulose alone tends to decrease the quantity of nitrogen fixed, but when mixed with manure there is no decrease, whereas the quantity is increased by the administration of manure alone. G. B.

The Effect of Fertilizer Salts Treatments on the Composition of Soil Extracts.

SPURWAY, C. H. *Michigan Sta. Tech. Bul.* 45, pp. 18, 1919.

Four sandy loam soils, two acid and two alkaline to litmus paper, were treated with fertilizer salts in the proportion of 1 gm. of fertilizer salt to 1 kg. of soil, placed in a percolation apparatus and leached twice with

distilled water, after two days and also after fifteen days standing, with three litres of distilled water at each leaching. Salts used: KCl, commercial acid phosphate, commercial slaked lime, $CaSO_4$, NaCl, $NaNO_3$, $Ca_3(PO_4)_2$, $CaH_4(PO_4)_2$ and $CaCO_3$. The leachings were analyzed for SiO_2, P_2O_5, SO_3, Cl, Ca, Mg, Na, K, Fe_2O_3, Al_2O_3 and combined CO_2. Chemical analyses of the soils are given.

The treatments had certain well defined effects on the soils. Application of soluble chemical compounds to soils change markedly the chemical composition of the soil extracts, and when these soluble constituents are removed the soil is left in a permanently charged condition. The SiO_2 of alkaline soils was found to be more soluble than that of the acid soils. Non-phosphate salt treatments generally increased the amount of phosphorus in the soil extracts. The basic radicals of the salts, KCl, $CaSO_4$, NaCl and $NaNO_3$ occurred in the second leachings in greater quantities than the acid radicals, showing that a transformation had taken place and that these basic radicals were combined with other acids, mainly as carbonates. Comparatively large quantities of iron and aluminium were found in the second leaching from the $CaCO_3$, $NaNO_3$, $CaSO_4$ and phosphate treatments. All treatments except those of slaked lime and $CaCO_3$ left the soils acid to litmus paper. C. H. S.

Studies on the Reactions Between Soils and Various Chemical Compounds.

SPURWAY, C. H. *Michigan Sta. Techn. Bul.* 51, p. 39, 1921.

This work was designed primarily to study reactions between alkaline and acid soils of various classes and neutral salts, bases and hydrolyzing salts.

100 gms. of air-dried soil and 500 cc. of solution containing, usually, one hundredth part of the formula weight of the chemical used, were brought into contact, in glass containers, at laboratory temperature for one hour, and the solution separated from the soil mass by decantation. Soils used: acid and alkaline (litmus paper test) soils of each of the following classes: medium sand, sandy loam, silt loam and clay loam. Chemicals used — KCl, K_2SO_4, KNO_3, $(NH_4)_2SO_4$, $Ca(NO_3)_2$, $CaSO_4$, $CaCl_2$, $MgCl_2$, KOH, $Ca(OH)_2$, K_3PO_4, $CaH_4(PO_4)_2$, $Ca(C_2H_3O_2)_2$, $KC_2H_3O_2$, $K_2C_2O_4$, $FeCl_3$.

The alkaline soils generally fixed greater quantities of the cations of the neutral salts than the acid soils of the same class, but the degree of fixation depends upon certain soil elements, chiefly calcium and magnesium, with smaller quantities of sodium and potassium, in chemical combinations that react with the neutral salts, and not on the reaction of the soil. Extracting the eight soils with HCl and washing, greatly reduced the quantities of potassium fixed from KCl by the soils. These soils did not fix equivalent quantities of calcium, potassium and magnesium from neutral salts of these elements. The fixation of potassium was correlated with the exchange of calcium and magnesium from the soils, and the fixation of calcium with the exchange of magnesium, and the fixation of magnesium with the exchange of calcium. The fixation of potassium from KCl by

carbonate and non-carbonate soils, was closely correlated with the quantities of calcium and SiO_2 found soluble in 0.2 N HCl. When the acid and alkaline sandy loam soils were saturated with certain cations at equal solution concentrations, then the fixation of the other cations used at the same concentration was closely equivalent. The reactions between soils and neutral salts were reversible in all cases studied. Much greater quantities of calcium were fixed by the soils from $CaCl_2$ after these soils were treated with $MgCl_2$, than before this treatment. These observations contain strong evidence that the reactions involved are of a chemical nature, and that the chief cause of fixation from neutral salts by soils, is the presence of chemical elements in combinations that react with the neutral salts, forming an insoluble compound with the salt cation and some soil acid ; and the degree of fixation is considered to be dependent upon both kind and quantity of the reacting ions present.

Potassium and calcium were fixed from hydroxides in large quantities by all the soils used without equivalent exchange of soil elements ; but a portion, at least, of the potassium and calcium fixed from hydroxides is held by the soils in an exchangeable condition.

In general, the alkaline soils fixed greater quantities of the basic ions of hydrolyzing salts used than the acid soils, but a greater degree of fixation was observed from the hydrolyzing salts than from the neutral salts. The fixation of one ion of an alkaline hydrolyzing salt was apparently independent of the fixation or combination of the other ions of the same salt. In the case of $FeCl_3$, the iron fixed by the soils was nearly proportional to the calcium found in the soil extracts, showing that this reaction is mainly neutralization of the HCl produced and precipitation of iron as $Fe(OH)_3$.

Anions or acid radicals of the salts used that form insoluble compounds with calcium and magnesium were fixed by the soils, but anions of salts that form soluble compounds with calcium and magnesium are not fixed by soils, at least not to any great extent.

Coarse particles of limestone may be present in soils where the fine material may be acid.

Fixation of basic ions or elements from salts, is not a distinguishing characteristic of acid soils.

The reaction between soils and chemical compounds, especially with reference to products found and soil fixation, depends chiefly upon the manner of dissociation of the compounds used for the treatments and the solubilities of the possible combinations. The magnitude of the reaction depends upon the quantity relationship between the reacting compounds.

C. H. S.

Studies on Active Bases and Excess Acids in Mineral Soils.

Spurway, G. H., *Michigan Sta. Tech. Bul.* 57, pp. 27, 1922.

The object of this research was to determine the neutralizing value of soils for acids and alkalis, using the hydrogen electrode as the end-point indicator. In the titration work, 10 gms. of soil were placed into each of

several beakers, the number depending upon the range to be covered. 0.1 N equivalents of the different reagents used were added in quantities of one to 10 cc. and sufficient neutral, distilled water was added to each beaker to raise the liquid volume to 50 cc. Soils used: — medium sand, sandy loam, silt loam, clay loam and a miscellaneous series of soils. Reagents used: $Ca(OH)_2$, Al_2Cl_6 and HCl.

The neutralizing value of soils for acids and alkalis may be quite accurately determined and methods are given for this purpose. When soils are treated with $Ca(OH)_2$ the reaction proceeds slowly and comes to an equilibrium on P_H 7.00 with the quantity of $Ca(OH)_2$ required in at least 24 hours, but in the presence of an excess of $Ca(OH)_2$ an equilibrium was not obtained in three to eight days, indicating that this further reaction continues for a long period of time. $Ca(OH)_2$ forms salts with soil acids. A soil acid equilibrium may be obtained in about three hours in the presence of an excess of the acid, and this equilibrium is quite constant over a period of several days, showing that a rather sharp distinction may be made between reactive and inactive soil bases. Weak soil acids are split off when soils are heated with strong acids. There is a direct correlation between the base-acid ratio of soils and P_H. This base-acid ratio in soils is believed to be of great scientific and practical importance.

C. H. S.

The Decomposition of Organic Matter in Soils.

STARKEY, R. L. (New Jersey Agricultural Experiment Station). *Soil Science*, Vol. XVII, No. 4, pp. 293-314, 7 tables, figs. 5, bibliography. Baltimore, Md., 1924.

The author has investigated the decomposition of cellulose, dextrose, rice straw, alfalfa, dried blood, and a mixture of mycelium and fungus spores, in one and the same soil and in different soils, measuring the intensity of decomposition by the formation of carbonic anhydride. It was found that, in spite of what has been said to the contrary, this method is a good index of decomposition.

In the same soil, decomposition varies according to the various substances contained therein, and is very rapid in fertile soils. After two days the following were eliminated as carbonic anhydride: 35 % of the dextrose carbon, 20 % of the alfalfa, 19 % of the mixture of fungi, 16 % of the rice straw, 7 % of the dried blood and 0.5 % of the cellulose. Decomposition attains its maximum during the first few days.

The speed of decomposition varies according to the substances; the slowest is cellulose; then follow rice straw, alfalfa, fungus mixture, and dried blood; glucose is the most rapid of all.

Nitrates accelerate the decomposition of rice straw and cellulose, but have no effect on alfalfa. Rice straw tends to diminish the soluble nitrogen of the soil, whereas alfalfa and dried blood increase it.

Fertile, and almost neutral soils in general, decompose the organic matter more quickly than the less productive and the acid soils. The differences in the power of decomposition among the various soils, however, are not very great.

A. F.

Methods of Studying Soil Acidity.

TIDMORE J. W. and PARKER F. W. (Alabama Polytechnic Institute). Methods of Studying the Strength of Soils Acids. *Soil Science*, Vol. XVIII, No. 4, pp. 331-338. Baltimore, Md., 1924.

The three methods : TRUOG's acidity, sugar inversion, and hydrogen-ion concentration, give similar results, which proves that the hydrogen-ion concentration in soil solutions is to a great extent caused by the acidity of acid silicates.

By maintaining a constant specific resistence and hydrogen-ion concentration, the presence of acid soils greatly increases the sugar hydrolysis, without the influence of the solid phase being observed. Probably it is a question of a hydrogen-ion concentration greater at the surface of the soil particle than in the solution. A. F.

Investigations on the Changes in Soil Solutions during the Plant-Growth Period on various Ploughed Fallow Soils.

TROFIMOFF, A. W. *Journal für Landwirtschaftliche Wissenschaft*, No. 9-10. State Technical Publishers, Moscow, 1924.

The author has obtained soil solutions from various parts of the experimental field of the Moscow Agricultural Academy during a dry and a moist period of plant growth, by Prof. A. G. DOJARENKO's " petroleum-emulsion method ", and subjected them to a careful chemico-physical test by the same experimental method. The chief results may be summarised as follows :

(1) The concentration of the soil solution increases until the middle of the growth period, and decreases again towards the end. On absolutely fallow land the concentration is three times stronger than on recently ploughed land.

(2) The osmotic pressure, which is likewise 4-5 times greater on purely fallow land than on that recently ploughed, also attains its maximum during the growth period.

(3) The nitrogen content of the nitrate is likewise at its highest in the middle of the summer, and greater in purely fallow land than in recently ploughed land.

(4) The relative K, Mg and Ca content is equalised and causes a " buffering " of the soil.

(5) Anions are in excess of cations.

(6) The hydrogen-ion concentration was in all cases nearly neutral and was only occasionally inclined towards acidification, but always within the optimum limits for plant life. GOERNER.

Soil Colloids, their Action on Lime and Bicarbonate of Lime.

VINCENT, V. (Quimper). Emploi rationnel de la chaux et du calcaire dans les sols argileux ou acides. *Association française pour l'Avancement des Sciences*. Congrès de Bordeaux. 1923, pp. 1023-1025, published at Paris, 1924.

The combination of lime (CaO) with alumina (Al_2O_3) forms an insoluble tricalcic aluminate ; with gelatinous silica (SiO_2) an insoluble

tricalcic silicate; and with ferric hydrate there is no combination, but adsorption.

As regards the organic matter of the soil, there is a formation of humate with the acid part and a calcic combination with the nitrogenous hydrocarbon remaining, which may fix at the most 10 % of its weight of CaO.

In some soils, the proportion of CaO fixed per kg. of soil is 20 grams, whereas if calcium bicarbonate be applied the soil only retains 3 grams of CaO.

In the Brittany granite soils, the acidity determined by calcium bicarbonate is due almost entirely to the organic matter and not to alumina.

In practice, VINCENT advises the following applications: lime, to precipitate the colloids of a clay soil and thus make it easy to till and permeable to water; limestone (carbonate of lime) to neutralise the acidity of a humous soil.

Soils are alkaline when the ratio: lime soluble in acetic acid: 1 % organic matter is about 9 %.

To Brittany soils of average richness in organic matter (30-40 grams per kg. of soil), 1200 kgs. of pure carbonate of lime, or its equivalent of 570 kgs. of lime, should be applied annually.

DR. PIERRE LARUE.

Effects of Lime on Decomposition of Soil Organic Matter.

WHITE J. W. and HOLDEN F. J. (Department of Agronomy, Pennsylvania State College). *Soil Science*, Vol. XVIII, No. 3, pp. 201-218, 1 bibliography. Baltimore, Md., 1924.

The experience of forty years shows that there are no fundamental differences between the action of quicklime and that of crushed limestone on soil organic matter. Both substances, applied in quantities eight times greater than that used for calcareous soils, gave a considerable increase in nitrogen over that in soils not treated. There is no sign whatever of any destruction of organic matter by the quicklime, as might have been feared. Indeed there is a greater preservation of nitrogen and organic matter with lime (in the form of quicklime or limestone) than in soil not treated.

A. F.

Method for Testing Artificial Fertilisers.

(*Methode zur Untersuchung der Kunstdüngemittel*). Compiled and published by the German Fertiliser Manufacturers' Association ("Verein Deutscher Düngerfabrikanten"). VI. Edition. Publ. by F. Vieweg, Son & Co., Brunswick. 1925.

A laboratory book for chemists engaged in testing fertilisers.

SCH.

Biological Properties of Soils.

The Protozoan Fauna of the Soils of the United States.

ALLISON R. V. (Rothamsted Experiment Station). *Soil Science*, Vol. XVIII No. 5, pp. 339-352, 1 fig. bibl. Baltimore, M., 1924.

The examination of a series of soil samples taken in various parts of the United States shows considerable uniformity in the distribution of the more important flagellates, ciliates and rhizopods. *Heteromita* sp., *Cercomonas* sp. and *Cicomonas* sp. were found in all of them; *Dimastigamoeba gruberi* in 95 %; and *Sainouron* in 65%. In general, the types of genera were similar to those met with in England.

As regards the quantity of protozoa present, on the contrary, the author obtained rather low figures as compared with those obtained in England; the ciliates especially were scarce or absent. The maximum number of flagellates was 10,314 and the minimum 15; and the amoebae varied from 3,114 to 22. In some cases, all, or almost all the protozoa were found in the cyst stage.

The following conclusions may be drawn: It is considered that the protozoa cannot act as a limiting factor, especially in conditions of partial sterilisation. Now, following on the author's investigations, the query may arise as to whether this depends, not on the lack of the capacity of the protozoa themselves to act as a limiting factor, but rather on their limited numbers, owing to which they can exert no decisive influence. A. F.

The Density of Unicellular Organisms.

ALLISON, R. V. *Annals of Applied Biology*, XI, pp. 153-168. 1924.

When it is desirable to calculate the total mass of the micro-organic population of soil or other media, a knowledge of the density of cells, calculated from numbers and dimensions, is important. The author measures the rate of fall of unicellular green Algae (*Scenedesmus* sp.) in water and calculates the density therefrom by the formula of STOKES. The mean density of that organism was found to range between 1.07 and 1.15. The density of certain unicellular animals is also reported. By applying the formula of HEHNER and RICHMOND to the values for density, the percentage of dry matter has been calculated. P. H. H. GRAY.

The Action of Protozoa on Bacteria when Inoculated into Sterile Soil.

CUTLER, D. W., *Annals of Applied Biology*, X, pp. 137-141, 1923.

Proof that Protozoa are normal agents that keep down bacterial numbers in field soil is adduced in an experiment lasting 21 days wherein soil sterilised by intermittent steam is inoculated with:

(*a*) Bacteria alone;
(*b*) Bacteria and a species of Amoeba;

(c) Bacteria and a species of Flagellate, with the following results:

(a) Bacteria alone rose to 214 millions per gramme on the 6th day and maintained a level of 160-135 millions from 8-21 days.

(b) Bacteria with amoebae present rose to 177 millions at the 3rd day and fell to 66 millions on the 8th day, fluctuating between 70 and 30 millions up to the 21st day.

(c) Bacteria with flagellates present rose to 100 millions on the 7th day, fell to 50 millions on the 16th day, and fluctuated between 40 and 70 millions up to the 21st day.

Protozoa were in the active (trophic) form during the 15th 21st days of the experiment ; the normal relationship between them and the bacteria thus appears to have been maintained.

P. H. H. GRAY.

A Quantitative Investigation of the Bacterial and Protozoan Population of the Soil, with an Account of the Protozoan Fauna.

CUTLER, D.W., Lettice M. CRUMP, and H. SANDON. *Phil. Trans. Roy. Soc. Lond.* Ser. B. Vol. 211, pp. 317-349, 1922.

The results are given of 365 consecutive counts made daily, from July 5th 1920 to July 4th 1921 of the numbers of bacteria and of six species of protozoa in a normal field soil. The soil samples, consisting of a mixture of six cores 9'' deep, were taken from an experimental plot that annually receives 14 tons of dung per acre, two feet, separating adjacent cores so that variations in numbers of micro-organisms due to unequal distribution might be avoided. The bacteria and protozoa were counted by dilution methods, which are described, using THORNTON's count medium for the former, and CUTLER's technique for the protozoa. A summary of the complete data obtained is given in tabular form.

Both the bacteria and the protozoa were found to fluctuate greatly from day to day ; these fluctuations could not be correlated with meteorological or soils conditions. Seasonal changes in the soil micro-organic population are found to exist in addition to daily variations in numbers. Both bacteria and protozoa were at their maximum at the end of November, and at a minimum during February. Temperature and rainfall were not found directly to influence these seasonal changes. A comparison is made between these seasonal fluctuations in field soil and similar changes occuring in aquatic organisms.

An inverse relationship was found to exist between the numbers of bacteria and active (trophic) amoebae in 86 % of the total observations. A two-day periodicity, more marked in March than in July 1921, was shown for the active forms of one species of soil flagellate, *Oicomonas termo*. Auto-intoxication is suggested as a possible cause for this periodicity at certain times of the year, but not for the whole period under observation.

P. H. GRAY.

On the Partial Sterilisation of Peat.

DEMOLON, A. (Laon) Association française pour l'Avancement des Sciences. Congrès de Bordeaux, 1923. Published in Paris, 1924, pp. 1025-1026.

Peat, after being heated for a quarter of an hour at 100°C, instead of a partial sterilisation of its microbic reactions, shows a super-activity in the form of an increased discharge of carbonic anhydride.

Why is peat passive in its natural state (before heating)?

The following are the results of M. DOLOMON'S experiments:

1. The liquid with which the peat is impregnated contains no substances which obstruct microbial development.

2. Chemical antiseptics such as carbon disulphide, toluene and naphthaline remain inactive.

3. After boiling a culture, the microbial phenomena are intensified.

4. The acid reaction of peat in chalky soil is $P_H = 6.4$ to 6.8. No neutralisation takes place.

It is concluded that the poorness of the mass in nutrient elements prevents reaction in peat.

The results of heating are:

(*a*) The formation of ammonia in the cores of soil;

(*b*) the increased solubility of the mineral substances (0.30 gms. to 1.20 gms.), among which phosphoric anhydride (P_2O_5) and potash (K_2O) become soluble.

The addition of mineral fertilisers is therefore a primary condition for rendering peat soils productive. PIERRE LARUE.

The Influence of Nitrifying Bacteria on the Growth of Barley.

FRED, E. B. (University of Wisconsin). *Soil Science*, Vol. XVIII, No. 4, pp. 323-330, figs. 2. Baltimore, Md., 1924.

Growth tests on SHIVE solution, in which calcium nitrate was substituted by ammonium sulphate. In some of the pots a culture of nitrifying bacteria was added. The yield of barley in the pots to which the nitrifying bacteria were added was almost double that of the check. The beneficial influence of such bacteria is therefore proved. A. F.

Nitrification in South African Soils.

HALL T. D. (School of Agriculture and Experiment Station, Potschefstroom). *Soil Science*, Vol. XVIII, No. 3, pp. 219-235, bibl. Baltimore, Md., 1924.

The author continues his investigations on the nitrifying power of 30 soils in the Transvaal, the partial results of which were published in this *Review* (Vol. XII, No. 4), and has now been enabled to draw the following general conclusions:

The factors which influence nitrification in the climatic conditions observed by the author, more than the temperature, are moisture and

aeration. The seasonal changes show that there is a production of nitrate which would be sufficient for the majority of the crops in such types of soil, and this explains the small effects obtained with nitrate fertilisers.

It appears that the drying of the soil in the winter season, and the frosts also, increase the nitrifying power when conditions become favourable again for nitrification. Nitrification is scarce in samples taken at a depth of about 30 cm. and is almost nil at a depth of 1.80 m.

In acid soils also nitrification is good and not improved by the addition of lime. It was also satisfactory, except in two cases, in soils under tobacco, in which the subsoil nitrifies better than the surface soil.

A. F.

Investigations on Azotobacter.

NIEMEYER L. Azotobacter Studien. *Botanisches Archiv*, Vol VII Parts 5-6. Königsberg, 1924.

The author's investigations are divided into two parts. In the first the problem is considered from the ecological and the botanical-geographical point of view. The subject of these preliminary investigations is the diffusion of *Azotobacter* in the various soils and the conditions necessary for its development. In the second part the problem is considered from the morphological point of view and its historical development.

The presence of *Azotobacter* in soil is mostly influenced by the aeration and chemical reaction of the soil. *Azotobacter* was found in 54 % of the soils analysed, the acidity of which was determined by the WHERRY method.

The limit of soil acidity concomitant with the presence of *Azotobacter* was found by the author to be P_H 5, whereas that of alkalinity could not be determined in the soils examined.

Azotobacter was found in 74 % of cultivated soils. Those in which it was impossible to detect the presence of *Azotobacter* all showed less than P_H 5.5 of acidity.

The difference in percentages as regards uncultivated and cultivated soils respectively, is due to the fact that among the first some showed clearly acid reactions, and others, though from a biochemical point of view fulfil the conditions necessary for the development of *Azotobacter*, were found to be insufficiently aerated. Tilled soils are aerated by ploughing and only in exceptional cases do they show acid reaction.

Azotobacter was also found in roads; newly formed fields may therefore be easily infected. *Azotobacter* was likewise found in the Islands of Juist and Heligoland, as well as in the waters of the North Sea, some yards from the shore (Juist Island).

As regards morphology and the history of the development of *Azotobacter*, the experimental material was supplied by two species from Muenster and Juist; they presented no appreciable morphological difference. The pigmentary formation was found to be more marked in the Juist than in the Muenster species. In neither case was it possible to establish any

relation between the lime content of the soil and the formation of the pigment.

In the Muenster cultures, cells free from glycogen were observed, these cells having appendices of rod-like from, which, as regards colouring matter and reagents, behaved like the cells themselves. No further development of such formations was observed and their importance seems doubtful.

In the works of LÖHNIS and SMITH *Azotobacter* is studied under several forms, which may be classified in 3 distinct groups: (1) Developed forms; (2) Regenerated forms; (3) Symplastic and combined forms.

A. F.

Bacteria which fix Nitrogen in Vesuvian Soils.

RICCARDO, S. (Institute of Agricultural Bacteriology in the Royal Higher School of Agriculture, Portici). First contribution to the knowledge of bacteria which fix nitrogen in Vesuvian soils. *Annali della R. Scuola sup. di agricoltura in Portici*, Series II, Vol. XVIII, pp. 1-50, figs. 3, bibliography. Portici, 1923.

The object of this work is to examine the result of a successive application of schizomycetic species in Vesuvian virgin and sterile soils before the growth of algae, lichens and mosses. From the results, on the completion of the investigation, it will be possible to determine whether or not there exists a succession of those pre-eminently agricultural processes (putrefaction, nitrification, denitrification, fixation of nitrogen) and also whether there are soils in which such process do not take place.

In the Vesuvian plain soils, besides *B. amylobacter*, there are many rounded forms which must in all probability be classed with the so-called nitro-bacteria; on the other hand the nitrogen fixers are absent or extremely rare at a height of 310 m. and also of 878 m.

Six species of nitrogen fixers were isolated; one of these, an anaerobe, corresponds to *B. amylobacter*, hence it may be concluded that the anaero-nitro-bacteria come within the group of such bacteria; investigations must be made however in order to discover whether the other types isolated at various heights are in every respect identical with the type isolated on the said plain and heights.

Among the other species having the common quality of fixing nitrogen and of being aerobic, three belong to the schizomycetes and two, most probably, to the *Mycoderma* genus. The systematic position of these species and the relations between them and those considered as belonging to the *Azotobacter* genus will form the object of further research.

A. F.

The Streptotriceae of Vesuvian Soils.

RICCARDO, S. (Institute of Agricultural Bacteriology, Royal Higher School of Agriculture, Portici). *Annali della R. Scuola sup. di Agricoltura in Portici*. Series II, Vol. XVIII, pp. 1-14. Portici, 1923.

In the Vesuvian soils which were most affected by the action of the cinders of the 1906 eruption, the streptotriceae are not numerically great.

The author has isolated a species which may be considered to be *Actinomyces chromogenes Gasparini albus* L.; e. N.

It has no pathogenical power but seems to have a certain capacity to fix nitrogen. A. F.

Some Protozoa from Soils Collected by the "Quest Expedition" (1921-1922).

SANDON, H., and CUTLER, D. W. *Journal Linnean Society Zoology* XXXVI pp. 1-13, 1924.

Soils collected from widely distributed localities in the Atlantic Ocean, (St. Paul's Rocks, South Georgia, St. Vincent, Elephant Island, Tristan da Cunha, Gough Island, St. Helena and San Miguel, Azores) were found to contain types of Protozoa mostly identical with those found in English soil and soils from other parts of the world. The soils which had been cultivated for many years contained the richest protozoan fauna. A total of 92 species were identified. P. H. H. GRAY.

On the Development of a Standardised Agar Medium for counting Soil Bacteria.

THORNTON, H. E. *Annals of Applied Biology*, IX. pp. 241-247, 1922.

In order to make an accurate estimate of fluctuations in the numbers of soil bacteria, a medium is required which will give constant results, be reproducible at different times or by other workers, and allow in a single soil suspension the development of numbers differing only within the limits of random sampling variance. This constancy in results with a plating medium depends mainly upon the following factors:—

A. The composition of the medium must be constant.

B. There must be little interference between developing colonies, *e. g.* rapidly spreading colonies must be checked.

C. The growth of fungi must be kept down.

D. There should be only slight variation in hydrogen-ion concentration. Reproducibility has been obtained for the medium by the use of pure chemical compounds and such constituents as will not change appreciably the reaction in an agar substrate. The medium here developed also represses the rapid growth of *B. dendroides* over the surface of the agar by reducing its rate of multiplication, and the development of fungi is considerably checked.

The medium has the following composition:

K_2HPO_4	1.00 gm.	KNO_3	0.5 gm.
$MgSO_4 7H_2O$	0.20 »	Asparagine	0.5 »
$CaCl_2$	0.10 »	Mannitol	1.0 »
NaCl	0.10 »	Agar	12.0 »
$FeCl_3$	0.02 »	H_2O	1000 cc.

The method of its preparation can be carefully standardised in order to produce comparative results. The following technique was finally

adopted. The K_2HPO_4, KNO_3, and asparagine are dissolved in distilled water; the $MgSO_4$, $CaCl_2$. NaCl and $FeCl_3$ added from standard solutions in the order named. The agar is then added and dissolved in the steamer at 100°C.

At this temperature the medium is filtered by passing it twice through a layer of cotton wool. To the filtrate the mannitol is added: at 60°C. the reaction is adjusted to P_H 7.4 with Brom-Thymol Blue, and the tubed medium is sterilised for 15 minutes at 15 pounds pressure. The optimum temperature and time for incubation with this medium is found to be 20°C. for 10 or 12 days. P. H. H. Gray.

Soils and Vegetation.

Deficiency in Nitrate caused by the application of Wood Waste.

Arrhenius, O., Ett fall av nitratbrist åstadkommen genom inblandning av träavfall. Medd. 276 från Centralanstalten för jordbruksförsök.

The author describes an instance of a market garden which was completely ruined by a "compost" of wood shavings. Cucumbers, tomatoes, lettuce, strawberries, etc., showed evident signs of deficiency in nitrate and finally perished.

An application of nitrate fertiliser prevents this result. Frequent dressing with nitrate in solution is suggested. A.

Soil Reaction and Yield.

Arrhenius, O. Markreaktion och skördeutbyte. Medd. 278 från Centralanstalten för jordbruksförsök.

The author shows that the various cultivated crops have different requirements as regards soil reaction. Various growths of the same species of plant even may show differences. That the results of the pot-tests are also applicable to field crops is proved by field tests.

The author proposes the following methods for utilising to the utmost the results obtained:

(1) To cultivate those plants which respond to soil reaction;

(2) In special cases to adapt soil reaction to the plants it is desired to cultivate;

(3) As a third possibility it is proposed to use various kinds of plants on different types of acid soils. A.

Recent Investigations regarding the Utility of Stable Manure Nitrogen in Field Soils.

Barthel, Chr. Nyare undersökningar rörande stallgödselkvävets utnyttjande i åkerjorden. *K. Lantbruks Akad. Handl. o. Tidskr.* 1925.

The author refers to earlier observations, and shows that the increase in the number of micro-organisms, which should result from stable manur-

ing, probably has no influence on the microflora of the soil, for the proportion of the microflora is generally already established.

The author would therefore attribute to stable manure not a direct, but an indirect biological influence.

Tests made at the Swedish Central Agricultural Station show that the ammoniacal nitrogen in stable manure is nitrified during the first year. The organic nitrogen on the other hand dissolves very slowly, as was proved by tests with stable manure freed from ammonia. Stable manure therefore is a very important source of nitrification only during the first year.

For decomposing cellulose ammoniacal nitrogen is of much greater importance, as was shown by BARTHEL and BENGTSSON. This therefore is another indirect influence of stable manure and not, as was formerly believed, an accelerated decomposition of cellulose through the importation of cellulose-fermenting organisms.

A.

Soil Acidity and its Relation to Ammonification and Nitrification of Woodland Soils.

CLARKE, H. R. (*Oxford Forestry Memoir No. 2*) *The Indian Forester*, Vol. L, No. II, pp. 580-593. Dehra Dun, U. P., India, 1924.

The close relation between the plant and its habitat is well known and that the reaction of the soil is an important factor in plant distribution, the growth of each type of plant being most successful within a specific reaction.

The total acidity of a soil is a quantity factor, measured by the amount of the base required to combine with the whole amount of acid present. The active acidity of the soil, the concentration of hydrogen-ions, is, on the other hand, a measure of the intensity factor of soil acidity.

In correlation between soil types and forest types and plant associations, the activity of the microflora of the soil is a significant factor. The organisms which bring about ammonification and nitrification are of great importance, and a study of these bacteria with regard to hydrogen-ion concentration is of value.

The author in his studies employed GILLESPIE's method for estimations of hydrion concentration, and HUTCHINSON and MCLENNAN's to determine the lime requirement. The estimation of ammonia was made by MATTHEW's method, and the determination of nitrates by means of phenoldisulphonic acid.

A definite relationship was found between the lime requirement of a soil and its organic content. The pH value of a soil growing a forest is least acid when the forest is in full growth. The accumulation of ammonia is greater in very acid soils than in slightly acid or neutral soils. The ammonia of a very acid soil is liable to rapid fluctuation. Nitrate is present in measurable quantities in very acid soils and is apparently independent of seasonal changes, under the conditions of the author's investigations, in which the soils studied were taken from woodland.

W. S. G.

The Effect on Crop Yield of Mixing Light Sandy Soil with Meadow Marl, Low Moor and Clay Soils.

GERLACH, *Landw. Jahrbücher*, Vol. 61, p. 153. Berlin, 1925.

The author's investigation on this subject in Mocheln and Bromberg showed that in general the very beneficial influence of meadow marl, clay and low moor soil on unfertilised plots is greater than on fertilised. On the other hand the deleterious effect of an admixture frequently becomes very evident, especially on unfertilised plots. The advantage of such mixing, from results obtained in Mocheln, seems somewhat doubtful, but the results obtained in Bromberg were rather more favourable. By the use of clay and low moor soil the deposit seems to be improved, yet the result in this direction are not uniform. Meadow marl, clay and low moor soil should act directly as a fertiliser on the light sandy soil, poor in nutrient substances. It must also be considered that soil reaction is greatly influenced by these additions.

In any case, only after the question of the advantage of the process has been proved, can it be decided whether, and to what extent, the admixture of certain substances to a sandy soil is advisable.

NIKLAS.

Effect of Salts on the Intake of Inorganic Elements by the Plant.

HOAGLAND, D. R. and MARTIN, J. C. *University of California, College of Agriculture, Technical Paper No.* 8, pp. 26, tables 7, figs. 5, bibliography. Berkeley, Cal., 1924.

The authors carried out a series of experiments to study the effect of alkali soils or solutions on the chemical system of the plant, in order to obtain a better understanding of the relation of the plant to the medium in which it grows. The experiments were made on barley, beans, peas and pumpkins. Attention is drawn to the variation of the effects of salts on plants according to environment, temperature, humidity, etc.

Sodium chloride and sodium sulphate tended to decrease the absorption of calcium, magnesium and potassium. When sodium chloride is used, sodium and chlorine may be absorbed and stored by the barley plant in relatively large quantities. In the case of sodium sulphate, the sulphate ion is removed less rapidly from solutiont han the chlorine ion ; this is true for barley, cucumber and melons.

Observations were made on the effect of salts on the reaction and buffer systems of barley, peas and pumpkins. Rapid and extreme changes in the reaction of the sap expressed from the roots were caused by the addition of sodium bicarbonate to the culture solution. Calcium chloride produced changes in the reaction and buffer effect of the plant juices. Barley and pumpkins were influenced in opposite directions. Neutral sodium salts caused slight changes in reaction and titration values. Sodium nitrate increased the alkalinity of the root sap, with accompanying injury similar to that induced by sodium bicarbonate.

A brief general discussion of certain phases of alkali injury to plants is given. W. S. G.

The Natural Increase of Metal Salts and other Inorganic Compounds in Plants.

VON LASSTOW, O., *Die natürliche Anreicherung von Metallsalzen und anderen anorganischen Verbindungen in den Pflanzen*. Verlag des Repertoriums, Berlin-Dahlem, Fabeckstrasse, 49, 150 pp., 1924.

This work reviews the plants which are associated more or less to a soil of a definite chemical composition, or at least prefer such a soil, and further indicates those plants which are enabled to draw from or to increase one or more of the constituents of such a soil. SCHUCHT.

The Effects of Additions of Nitrogen, Phosporus and Potassium on Nitrogen Economy.

MORRIS V. H. (Ohio Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 2, pp. 87-97, bibl. Baltimore Md., 1924.

Nitrogen is one of the most important plant constituents, it is the most costly, and is also easily lost in leaching. Hence the great utility of investigations directed towards preserving the nitrogen left in the soil, and the most scientific method of its application.

Tests covering a period of 30 years in a fine sand and silt soil, with quinquennial rotations of maize, oats, wheat, clover and *Phleum pratense*, have shown an average loss of 22 % of the original supply of nitrogen. Plots treated with lime lost similar quantities of nitrogen to those which were not treated ; in the last 10 years the loss was greater even, in those treated.

The use of fertilisers (potassium chloride and acid phosphates) resulted in a preservation of nitrogen directly proportional to the increased yield due to the fertilisers themselves. In this case the lime increased the quantity of nitrogen preserved by applications of fertiliser. A. F.

A Critical Enquiry into the Alleged Fixation of Nitrogen by Green Algae.

BRISTOL MURIEL, B. and PAGE, H. J., *Annals of Applied Biology*, X, 378-408, 1923.

WANN's conclusions that Green Algae were capable of assimilating free nitrogen from the air in the presence of nitrates and glucose, were tested with pure cultures of four species of Green Algae under conditions almost identical with those used by WANN (*Amer. Journ. Bot.* VIII, 1-29, 1921). The method of chemical analysis used by WANN for media containing nitrates is shown to be faulty, and the probable source of error is indicated.

In this experiment the average percentage recovery of nitrogen was for the cultures 99.28 per cent., and for the controls 99.25 per cent.

P. H. H. GRAY

Relation of Soil Moisture and Available Nitrogen to the Yield and Protein Content of Wheat.

NEIDIG A. E. and SNYDER R. S. (Idaho Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 3, pp. 173-179. Baltimore, Md., 1924.

The results of the authors' previous investigations were that, moisture is the chief factor in wheat production and also as regards protein content, provided that sufficient nitrogen is available. The present investigations prove that a high percentage of moisture in a soil containing sufficient available nitrogen, gives an abundant wheat yield with a high protein content. If on the other hand, under the same conditions, the moisture is deficient, there is a lower yield, but with a still higher protein content. This last factor may be attributed to grain shrinkage.

If, with good moisture conditions, the nitrogen is insufficient during the period of heading and ripening, but high during the first periods, there is an abundant yield with a low protein content. If, on the other hand, while nitrogen remains the same, the moisture is deficient, the yield is low and the protein content varies with the amount of grain shrinkage.

Under natural conditions, abundant rains evenly distributed over the growth period, with an average soil, give a high yield with a low protein content ; in the same conditions, with a very fertile soil, there is a high protein content if the nitrogen was available throughout the life cycle of the plant. A soil in which wheat is continually grown produces a larger yield of grain when rains are plentiful, especially if these are scarce during the heading and ripening period. In general to obtain an abundant yield of good quality, suitable conditions as to soil moisture and high fertility are necessary

A. F.

The Importance to Plants of Nutritious Soil Substances with Interchangeable Bases and the Influence of Lime on Absorbent Soil Substances.

NOSTITZ, A., *Landw. Versuchsstationen*, 103, 159, 1925.

The author's investigations led to the conclusion that when an interchange of bases is impossible, the nutrient substances combined with bases can only assist the roots by attacking the absorption agents, whereby at the same time the absorptive power of the soil is weakened. This reaction proceeds rather quickly so long as zeolitic substances saturated with bases are present, but this easily attackable part is small. In field soils there are scarcely any aluminium silicates combined with bases available ; hence without an interchange of bases the available absorbent nutrient substances of the soil are not sufficient to ensure abundant nutrition. A corresponding carbonic acid-lime content of the soil acts as a buffer, in the sense that it prevents the decomposition of the zeolitic aluminium salts containing water, and thereby the soil's power of absorption is better ensured.

NIKLAS.

Injury caused to Plants by Mixing Sawdust with the Soil.

SOEDERBAUM, H. G., and BARTHEL, Chr. Inverkan på växtlighet av trädavfall i jorden. *Medd.* 271 från Centralanstalten för försöksväsendet på jordbruksområdet.

During the war, sawdust was generally used as a stable-litter, is still so used to a great extent in the sawmill districts of Sweden.

The authors show that arrest in plant growth took place through applying sawdust to sandy soil, 2 % of cellulose completely stopping nitrification of an otherwise normally nitrifying soil. This stoppage was of long duration. It is not caused by resins or similar substances, but is more probably due to the capacity of cellulose compounds to use up the nitrates.

If the cellulose in the soil is destroyed nitrification is resumed.

The arrested growth phenomena can be eliminated by the use of nitrate fertiliser. A.

Nomenclature, Classification and Mapping.

The Importance of Soil Maps in Agriculture.

NIKLAS, H., *Illustrierte landw. Zeitung*, 45, 37, 1925.

After describing the development of soil-mapping in various countries the author points to the importance in practical agriculture of representing the soil on a strictly scientific basis, especially as regards the estimation of soil and agricultural statistics, in which connection the author refers to his own extensive works on this subject. H. NIKLAS

The Foundation of Soil Mapping.

TILL, ALFRED, Vienna. With 2 sketch-maps in the text, pp. 95. Publ. by L. W. Seidel u. Sohn, Vienna, 1923.

The author divides soil science into analytical, dynamic and geographical pedology, and in this booklet treats of the importance and utility of soil-mapping. The work should lay the foundations for the beginning of soil-mapping in Austria. Contents : The search for a Natural Soil System ; Classification of Soils ; Soil-Mapping. SCHUCHT.

Synoptic Agropedological Map of the Czechoslovakian Republic.

Drawn by Prof. J. KOPECKY and Eng. J. SPIRHANZL. Prague, 1924.

Dividing the soils of the Czecho-Slovakian Republic according to texture into 8 types, the authors have drawn up a clear soil map, 100 × 45 cm. (explanations in Czek and French). The soil types are :

(1) Heaviest clay soils ;
(2) Heavy clay silt soils ;
(3) Cohesive sand-clay soils ;
(4) Ordinary silts ;
(5) Friable sandy silts ;
(6) Silty and humous sands, easily disaggregated ;

(7) The lightest quicksands ;
(8) Shallow stony soils, covered with forests.

This map is very useful to persons tudyingthe Czechoslovakian soils.

L. SMOLÍK.

Regional Soil Science.

Investigation of Soil Strata in White Russia.

AFANASSIEW, A. *Zeitschrift des landwirtschaftlichen Instituts Gorky.* Vol. II, 1924 (*Journal of the Gorky Agricultural Institute*).

The author reviews the soil types which go to make up the soil of White Russia, and the history of their formation during the Diluvial and Alluvial Periods. The results are summarised in the following general review of the soil strata :

I. Upper layer : Gravelly sand and sand without gravel (1 m.) ; or loamy sand (1 m.) ; or loess loam (0.30-1 m.) ; or loess (10 m.) ; or loam without gravel (up to 0.05 m.).

II. Middle layer : Gravelly coarse sand (0.1-1 m.).

III. Subsoil : Moraines, the upper sections of which contain gravel, or, in the neighbourhood of loess, humus formations (0.5-1 m.). At Gorky there are two, and at Vitebsk three moraines, one over the other, which are divided by 12-15 m. of very coarse sand. HELLMERS.

The Composition of some Sudan Soils.

JOSEPH, Dr. A. F. (Wellcome Tropical Research Laboratories, Khartoum). *Journal of Agricultural Research*, Vol. XIV, Part 4, pp. 490-497, tables 5, bibliography. London, 1924.

The article records the mechanical and chemical composition of some typical soils of the Sudan, e. g. (*a*) river flood alluvium brought down from the Abyssinian hills by rapid rivers and deposited in certain parts of the eastern Sudan ; (*b*) " Badob ", loess or cotton soil, an important area of which is the " Gezira " lying between the Blue and White Niles ; (*c*) Khor Soils, deposited in the beds of streams running only in the rainy season ; (*d*) Goz soils, reddish in colour and with a high percentage of sand, and a clay content of 5 to 50 % ; (*e*) Blue clay soils, found in the upper reaches of the White Nile, and which may contain as much as 75 % clay.

None of the above types are common in temperate climates ; they appear to be associated with large uniform plains having only the gentlest slopes. They are all alkaline and the organic matter rarely exceeds 1 % ; nitrogen is usually less than 0.05 %, phosphoric oxide extracted by 20 %, boiling hydrochloric acid varies between 0.1 and 0.2 %, in samples from the first foot of soil.

The Gezira badob soil alone contains particles above 2 mm. in diameter and these consist mainly of calcium carbonate. The coarse sand fraction consists of silica, except in the Gezira soil, in which it consists of 80 % of calcium carbonate. The fine sand fraction is mainly silica with

A mechanical analysis of the above soils gave the following results

Type	Flood alluvium	Badob	Khor soil	Gos soil	[illegible]
Locality	Kassala	Gezira Blue Nile	Um Ruaba Kordofan	Abu Haraz Kordofan	[illegible]
Colour	light brown	dark brown	black	red	[illegible]
Stones and gravel %	0.0	2.7	0.0	1.1	[illegible]
Coarse sand %	5.4	10.0	1.7	31.9	[illegible]
Fine sand %	15.7	19.2	15.2	34.8	[illegible]
Silt %	32.2	10.8	15.1	2.8	[illegible]
Clay %	46.7	57.2	68.1	29.5	[illegible]
Soluble salts %	0.028	0.100	0.035	[illegible]	[illegible]
pH	8.3	9.4	8.1	8.5	[illegible]

about 15 % basic oxides, except in the case of the Abu Haraz red soil where it is 98 % silica.

The clay fractions from Gezira, Um Ruaba and Nasser blue clay contain about 48 % silica and 38 % basic oxides. The clay from Kordofan red soil has 42 % silica and 45 % basic oxides.

It appears that a very important factor in determining the plasticity of a clay is its composition as shown by the molecular ratio of silica to alumina.

W. S. G.

Ukrainian Soil Investigations.

I. Prof. G. MAKROFF (Origin and evolution of Ukrainian soils). *Visnik Silsko-Gospodarskoi Nauki* (1) Vol. III, Nos. 3 and 4, pp. 6-22, map. Kharkov, 1924.

II. Prof. V. KROKOS (Loess and fossil soils of South West Ukraine). *Ibid.*, pp. 22-31.

I. — The author refers to the work of Prof. DOKUTCHAEFF, whose researches on Russian soils and particularly on the origin of tchernozem have become classic; he was the first to establish the method of natural zone classification, based on the conformation of the ground, and to seek the explanation of the origin of the soils in the influence of climatological, orographical and biological conditions. Prof. DOKUTCHAEFF's method has been largely followed in Russia and a series of valuable researches have since been made. Unfortunately these investigations have always been limited to a restricted area, and an extended survey over a region large enough to lead to wide general views, has not been possible until recently.

The author has succeeded in supplying this deficiency, thanks to the mission which was entrusted to him in 1921 by the Ukrainian Scientific

(1) *Journal of Agricultural Science*, published by the Scientific Agricultural Committee of Ukraine.

Agricultural Committee, and has been able to make a detailed examination of Ukrainian soils and to draw up a pedological chart. This investigation is not yet completed, but the author believes he has already obtained certain results which are not without interest and which are given in this article.

In the description of the Ukrainian soils, the author states that the country is divided into two climateric regions by the line of a barometric maximum which crosses the country from east to west, following a curve touching the towns of Kharkov, Poltava, Krementchoug, Kamenetz and Podolsk. To the north of this line the atmospheric precipitations are greater, and have an annual average of 500-600 mm. The summer is less warm and dry, the temperature more constant, with narrower deviations between maximum and minimum and the prevailing winds blow from the west; the climate of this region is termed a *cyclonic climate*. To the south of the barometric line the climate is dryer, with wider deviations between minimum and maximum temperature, and the prevailing winds come from the east. This is a *monsoon climate*.

From the orographical point of view, the author mentions the high land in the Provinces of Volhynia and Podolia which slope northward to the Pripet, eastward to the Dnieper and southward to the shore of the Black Sea. A second chain of high land forms the left bank of the Dnieper, a third, the Donetz chain (Kriaj), which joins the Berdiansk-Mariupol plain. The principal lowlands are those of the Pripet and Dnieper valleys, as well as the steppe, which forms the shore of the Black Sea, of which the lowest part is the North Tauride steppe.

The high lands are characterised by a moister and colder climate whereas the valleys have a warmer and much dryer climate.

The principal bed-rock on which the soil through the country has formed, is a loess of eolian origin, the upper layers of which afterwards become transformed into tchernozem, owing to the accumulation of plant residues which have supplied the humus.

The author distinguished three different kinds of loess: (1) sub-sand and sub-clayey loess of the northern region, which contains 82 % of SiO_2, 10 % of Al_2O_3 and 4 % of oxide of iron. This loess is very porous and of a very pale straw yellow. (2) The loess of the middle region is sub-clayey and contains 70 % of SiO_2 and 14 % of Al_2O_3. (3) The loess of the southern region is decidedly clayey and of a dark straw yellow, and contains 65 % of SiO_2 and more than 15 % of Al_2O_3.

In the regions of the north-west, towards the valley of the Pripet, at present covered with forests (called the Poliessia region), the upper layers of loess have become metamorphosed into podzol, marshy podzol and peat. In the whole of the remaining territory of Ukraine the upper soil layers are formed of tchernozem.

The northern zone, above the line of the barometric maximum, was at a certain epoch covered with forests, especially in the hilly region, whereas the steppes of the south supported only herbaceous vegetation. This is the cause of the difference observed in the qualities of tchernozem and in the thickness of the beds in these two regions. The author de-

scribes five tchernozem zones, characterised by different qualities and thicknesses of soil:

(1) The northern zone, of which the tchernozem contains 4 humus, the soil being slightly clayey and the carbonates it contains in the form of lublinite.

(2) The zone rich in tchernozem, of forest origin, and which ext southward as far as the line of the barometric maximum, the sout limit of the ancient forests. The tchernozem layer here has a dep 150 cm., and contains from 5-6.5 % of humus; the soil is sub-clayey the carbonates are also in the form of lublinite.

(3) The zone of the ordinary tchernozem, immediately to the s of the barometric line is characterised by a dryer climate. The soil is cla and sub-clayey and contains 6.5-7.5 % of humus, but the depth is not m than 100 cm.; the carbonates are of two forms, lublinite and "biloglazk the former being characteristic of a moister, and the latter of a drier mate. This zone extends in the direction of the Sea of Azov. But area extending from the littoral for a distance of 100 kilometres from t coast, to the Donetze chain, shows a certain difference in the soil mation; the tchernozem is only 90 cm. in thickness and contains o 5 to 6 % of humus, and the carbonates, though present in both form contain more "biloglazka".

(4) The southern zone towards the west, the steppes of the Bla Sea, is characterised by a soil 70-80 cm. in thickness containing 5-6.5 of humus, with carbonates in the form of "biloglazka".

(5) The zone of the shore of the Black Sea, lower and dryer th the preceding one, has a layer of tchernozem from 40 to 50 cm. in thic ness, which becomes more and more saline as it approaches the coast.

When discussing the question of origin, the author gives the differe points of view respecting the causes of forest growth in the north zone, whereas the steppes, to the south of the barometric line, had onl herbaceous, though very abundant vegetation. Apart from the influenc of a moister climate, certain scientists have tried to explain this fact b assuming the existence of an older plant evolution, the northern zo having emerged from the sea long before the southern steppes; othe explain the fact by the excessive salinity of the southern soils, of whic the saline solutions are more concentrated in consequence of the dryne of the climate. The author does not exclude the influence of these facto but considers the true explanation to be a combination of climateric, oro graphical and biological causes; in his opinion, *the northern zone has alwa been a region of more intense plant and animal life, owing to the cond tions of conformity, climate and sub-soil there ruling*. This view is support by the innumerable mole-hills with which the soil of this zone is covered though the rodents which made them were afterwards driven southwar by the forest-growth. The latter has caused great humification of the upp layer of the soil, which in turn has given rise to the formation of solub organic substances in the sub-soil, under the influence of which the break ing down of the silicious parts of the soil has taken place.

With regard to the degree of salinity of the soils of the southern z

and the plain regions, the author considers that the horizon of conglomeration of the soil at certain depth, may serve as a characteristic index for the degree of salinity. The conglomeration horizon is found at a depth of 20-30 cm. in the low plains, 40-60 cm. in the ancient forest zone, 40-50 cm. in the (ordinary) tchernozem and 80-90 cm. in the southern steppes.

In conclusion, the author again refers to the subject of Ukrainian loess and notes certain of its typical charactiristics. This soil is always intersected, at a certain depth, by sedimentary, beds, which divided the loess into several layers. The author considers that these layers are generally four in number ; their number increases towards the south and diminishes towards the north, on approaching the ancient regions of glaciation. The beds which separate the superposed loess sections are generally of fossil soil ; in the north, in the region of the ancient glacier of the Valley of the Dnieper, the layers of fossil soil are placed above the moraine. To the south of the glaciation region the fossil soils belong to the type of forest clays. In the southern steppe, the fossil soil has no trace of alluvial horizon.

II. — The article by Prof. V. KROKOS completes the above investigation by giving the result of the investigations made at a depth to investigate the stratification of the loess and the process of its formation. By means of borings to a depth of 18 metres, which however did not reach the tertiary rocks, the author observed that the loess layer is composed of at least four stages of which the deepest are separated by layers of fossil soil, while the last but one is separated from the last, by a layer of fossil soil and a deposit of moraine. The author explains the formation of these layers by the alternate advance and retreat of the Dnieper glacier. The four layers of loess would therefore correspond to four successive periods of glaciation. In receding, the glacier formed torrents of melted snow which carried away numerous small rock debris ; the moraines formed by these torrents afterwards disintegrated, and the wind, carrying away their dust, left deposits which by accumulation gave rise to the layers of loess. Indeed, the chemical analysis of the loess and the moraine below the first layer of loess, proved them to be of very similar chemical composition. The author explains the absence of moraines between the lower sections of loess by their complete disintegration and subsequent removal by wind. The moraine between the first (upper) and the second layer of loess remained intact, because at that period the great Dnieper glacier receded further, dividing into several small glaciers, and the light local winds which prevailed at that period could not entirely disintegrate the masses of rocks brought down by their torrents. The analysis of the loess revealed another interesting particular : the SiO_2 content decreases in all the layers of loess in proportion to their distance from the valley of the Dnieper ; this indicates that, during the accumulation of the loess a coarser substance than the dust of the moraines intervened, transported by the winds coming from that valley.

An examination of the layers of fossil soil which separate the layers of loess reveals the fact that all three layers are composed of ancient black soils, analogous to the present tchernozem, but which have lost most

that breaking up the soil (ploughing without turning the furrow), increases its porosity and stimulates the vegetative and functional activity of the aerobic micro-organisms and hence promotes the diffusion of air, yet the pulverised soil quickly loses its mellowness owing to the action of external agents (heavy rain alone is sufficient for this purpose). The utmost that deep breaking up the soil can do is to retard the inevitable caking.

Breaking up and pulverising the soil till it assumes a very fine texture increases its water-holding capacity and may decrease the circulation of the air owing to the rapid caking of the soil, since the water by removing the carbonate of lime disintegrates the soil particles and dissolves the colloids (clay and gelatinous compounds), which fill up the spaces between the clods.

In poorly-aerated soils, the injurious process of acidification may be set up as a result of anaerobic conditions that cause a reduction of the organic detritus.

The formation of large clods is not prevented by ploughing without turning the furrow, but it can be hindered by the surface ploughings that precede the operations of the gang-plough.

It is also doubtful how far ploughing without turning the furrow is really economical, for superficial ploughing and pulverising combined with thorough, deep ploughing can well replace the repeated breaking up of the soil as a means of combatting crust formation.

Further, the mouldboard has a tendency to reduce the traction force that would otherwise be required of the ploughshare and coulter, because it opens the furrow and raises the slice.

Finally, a somewhat uneven surface at seeding-time allows of the seed being drilled, while the clods protect the seedlings and support them to a certain extent. Hence in the opinion of the author, ploughing without turning the furrow cannot in any way be recommended from the agricultural standpoint.

F. D.

420. **Efficiency of Subsoiling.**

Journal of the Surveyors' Institution, Vol. III, No. 9, p. 479, London, 1924.

The results are now available of a five years trial of subsoiling carried out by the Ministry of Agriculture (London) in co-operation with the East Anglian Institute of Agriculture. The soils chosen were London clay, boulder clay, brickearth, sand and gravel. Fields were divided into strips, some of which were ploughed and subsoiled to depths of 5, 7 and 9 inches, and the remainder ploughed only. The subsequent treatment of the plots was identical.

The results have shown that in every case a greater yield has been obtained from the subsoiled plots than from plots which were ploughed only. The maximum increase was 67 % in the case of potatoes, and 50 % increases were frequently obtained. The value of the extra yield, on every occasion, more than paid for the increased cost.

[420]

The trials are to be continued for a further 4 years, and new plots are to be laid down in the Oxford area.
W. S. G.

421. **The Russian Tractor Industry.**

JEMTZEFF, WLADIMIR. Die neuesten russischen Traktor-Konstruktionen. *Die Landmaschine*, No. 15, pp. 203-205, figs. 4. Berlin, 1924.

According to the estimate made by a Russian Official Technical Commission, Russia would need during the next 10 years, 2 400 000 H. P. (corresponding to 120 000 tractors of the average 20 H. P.), in order to replace animal traction by mechanical traction in only 40 % of the total agricultural work.

The purchasing power of the rural population is very limited and the price realised by the sale of the crops of these 10 years would only buy 50 000 tractors at most.

The types of machine best suited to the conditions obtaining in Russia are 15-30 H. P. wheeled tractors and 20-50 H. P. caterpillar tractors. In both cases, the fuel used must be petroleum, naphtha, or other heavy oil. The most widely used machines are at present the American tractors "Titan" and "Holt" and the Russian tractors, "Gnom," "Saporoschetz" etc.

A scheme has been draw up for entrusting the construction of 600 wheel-tractors to the "Aksai" firm (Rostow on the Don), 1200 caterpillar tractors (of 50 H. P.) to the engine-factory at Charkow, and 1600 wheeled tractors to the Petrograd factories. It has been estimated that the proportion required is $^2/_3$ wheeled-tractors and ⅓ caterpillars. The credit granted for the year 1924 amounts to 2 336 000 gold roubles.

The characteristics of the Russian type of tractor correspond to the requirements of the country and are as follows: great simplicity of construction, solidity, and power of running on heavy oils. The materials used must be very durable and found within Russian terrritory to enable repairs to be made cheaply on the spot.

One of the first tractors made in Russia was the "Gnom". It develops 16-18 H.P. and has 3 wheels, the front wheel being the guiding-wheel and the two back ones the driving-wheels. It has a two-phase engine with two vertical cylinders and burns crude naphtha. It works like the Diesel but wthout compression. It is fired by high compression. In order to start the machine, compression is produced in one of the cylinders which is prevented from turning by means of a special valve. The revolution again becomes regular when the correct number of turns is obtained.

This tractor is suited to farms of 50-100 hectares; it can plough lightly, or harrow ½ hectare of land per hour. In autumn-ploughing with 3 plough bodies and a furrow 7 "zoll" deep, 3 hectares per 10 hours' day can be ploughed.

Next comes the "Saporoschetz" tractor made by the "Trust for the construction of agricultural machines of South Ukrania", which has

two fore guiding-wheels and one rear driving-wheel. It develops 12 H. P. It has a one-cylinder, two-phase engine also burning raw naphtha. This tractor is entirely made of Russian material. Its construction costs 1600 gold roubles (2 500 kg. material and 750 days of work). When tested, 2 hectares were ploughed to a depth of 7 " zoll " in 12 hours. It consumed 28 kg. of raw naphtha, or 4 kg. oil of naphtha, or 1.6 kg. petroleum and 151 litres of water per hectare.

Another tractor of Russian construction is that made at the Kolomna works in Moscow, which has a two-cylinder, two-phase engine burning crude oil. This tractor runs on 4 wheels and develops 25 H.P.

R. D.

422. **Suitable Types of Ploughs for India.**

COPLEY, H. (Agricultural Engineer, Central Provinces, Nagpur). *The Implement and Machinery Review*, Vol. 49, No. 585, pp. 1389-1390. London, 1924.

The author studies the question of ploughs in India under the following four heads : 1) economic aspect ; 2) ploughs already on the Indian market ; 3) whether European firms can turn out suitable ploughs for India ; 4) type of plough suited to the agriculturist in India. Mention is made of the British-made ploughs that have given good results.

The author is of opinion that the limited use of ploughs is not so much due to the price of the implements, as to reasons of rural economy (parcelling out of holdings, lack of cattle). On the other hand, he thinks that the light ploughs chiefly used in India might be made in the country more cheaply than in Europe ; they are now to be bought on the market at the price of 20 rupies. The disk plough is the best kind for India, but it must be simplified and adapted. In the central Provinces, a disk plough is now being turned out for 92 rupees and the price could be lowered if the machinery used in its construction were more up-to-date. R. D.

423. **Automatic Plongh.**

Charrue à mauœuvre automatique, *La Vie agricole et rurale*, Year 13, No. 8, pp. 122-123. Paris, 1924.

This implement is a plough with reverse, or shuttle action for working on the flat ; it can be used as a one-share, or multiple-share plough according to the nature of the work. The back wheel revolves on a pivot, while the two front wheels are on an axle that unites them at the end of the slanting arms which support the upper part of the implement (see figure 63).

By means of a handle disengaging a bolt, the two large wheels are propelled forward to a limited extent by a screw regulating the depth of the ploughing. At the same time, the back wheel is raised by the action of a series of levers, while a notch prevents it turning on the pivot.

In order to remove the plough from the soil, another movement of the handle clamps together the wheels, axle and the slanting arms, so that they become a lever which raises the whole implement, while the back wheel descends into its position revolving all the time. By means of the pull exerted by the large wheels, and through the action of a gearing arrangement and claws, the bolt that holds in position the bodies of the plough shoots out of its shealth and the claws make these bodies revolve and bolt themselves on the opposite side.

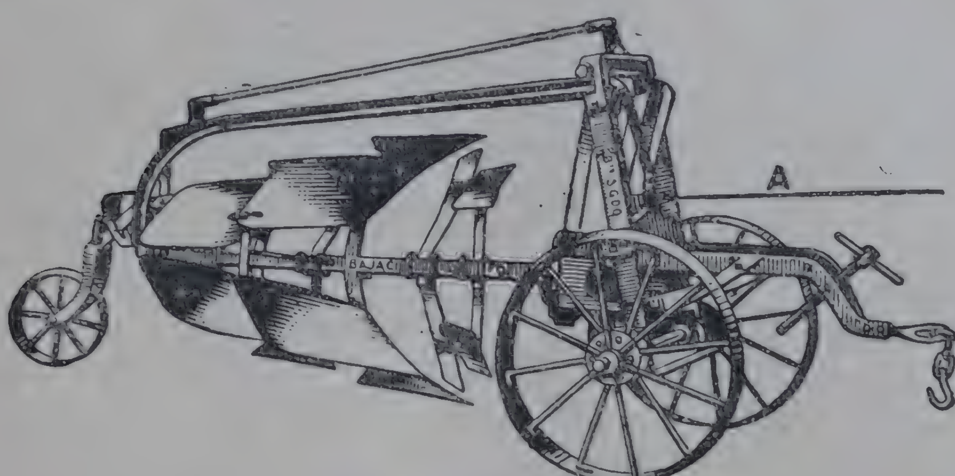

FIG. 63. — Bajac Phough with automatic adjustment.

Owing to the case with which the back wheel moves, the plough can turn in as short a space as the engine requires, and the driver controls all the operations of the plough.

The plough is made by the Bajac firm (France). R. D.

424. **Net Cost of the Mechanical Cultivation of the Vine.**

BUCHARD, P. Prix de revient de la culture mécanique de la vigne. *La Vie agricole et rurale*, Year 12, No. 22, pp. 374-375. Paris, 1923.

The " Office Agricole régional de l'Est " has had a number of comparative trials carried out near Epernay (France) in a vineyard where the vines were planted 1.20 m. apart, 1.40 m. being left between the rows. The apparatus was a 7HP. hoeing-machine of the G. L. I. type. The rows were 190 m. long and as the machine could only hoe a width of 0.85 m. it has to work twice down each row. The net cost of using this hoe was 560 francs per hectare. With a horse-hoe and hand-work the net cost was respectively 233 francs and 510 francs per hectare.

These figures show that hoeing with a tractor is expensive ; no doubt, the extra cost is to a large extent due to the imperfections of the present machines.

R. D.

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General Notices.

Rules of the International Society of Soil Science.

I. — Name, objects and headquarters of the Society

1. The Society shall be called the "International Society of Soil Sci
(French: "Association Internationale de la Science du Sol")
(German: "Internationale Bodenkundliche Gesellschaft")
(Italian: "Società Internazionale della Scienza del suolo")
(Spanish: "Sociedad internacional de la ciencia del suelo")

2. The object of the Society is the study and promotion of soil scien general by means of:

(*a*) the organisation of Congresses and Conferences;
(*b*) the formation of Sections and Committees;
(*c*) the publication of a Review;
(*d*) the institution of a Central Office for Soil Science bibliography umentation) at the International Institute of Agriculture at Rome.

3. The headquarters of the Society is the International Institute of A culture at Rome.

II. — Membership.

The International Society was founded by the Fourth International C ference and persons who took part in this Conference have the right to j the Society as foundation members.

Any individual or body corporate engaged in the study of soil science eligible for ordinary membership of the Society. The names of new memb must be proposed by two members and will be published in the review

5. The Congress may appoint honorary members on a proposal made the Executive Committee.

6. For particular countries sections may be formed within the Socie either for the study of soil science in general or for the study of certai aspects of the subject.

Every section consisting of more than 15 members has the right to b represented on the General Committee by one member.

III. — Constitution of the Society.

7. The Society carries out its work through the following bodies:

(*a*) the Executive Committee (Bureau),
(*b*) the General Committee,
(*c*) the Sub-Committees.

8. The Executive Committee is responsible for the general business of the Society. Its membership is as follows:

(i) the President,
(ii) the Vice-President,
(iii) two ordinary members,

(iv) a representative of the International Institute of Agriculture at ›me,

(v) the General Secretary,

(vi) the Editor of the Review,

(vii) the Librarian.

The President, Vice-President, General Secretary and Librarian are ap- ›inted on the first occasion by acclamation, afterwards by a majority ballot ›te of the members of the Association A new election of the President, Vice- esident, the ordinary members, the General Secretary and the Librarian kes place at each Congress. All are eligible for re-election with the exception the President, who by the rules of the Society must always be a member the Society belonging to the country in which the next Congress will be held.

The representative of the International Institute of Agriculture at Rome appointed by that Institute.

The duties of the General Secretary may be discharged by one of the other iembers of the Executive Committee. The necessary staff and funds will be ›und by the same body.

The editor of the Review is elected by the General Committee: he con- inues in office and can only be removed by a two-thirds majority of the ›eneral Committee.

9. The General Committee is composed of the Executive Committee and certain number of members elected by the Congress by show of hands, and lso representatives of the Sections (§ 6) and of the Sub-Committees (§ 10).

Each State has the right to be represented on the General Committee y at least one member.

The General Committee drafts the agenda for the Congress and for the Sub- ommittees. It meets as required, and at least once in the interval between ie meetings of the Congress.

The President of the Executive Committee is chairman of the General ommittee.

10. The Sub-Committees are appointed by the Congress or by the General ›mmittee for the study of particular aspects of soil science. They determine ieir own constitution and have the right to add to their numbers directly. iey are represented on the General Committee by one member.

IV. — The Congress.

11. The Congress is under the general patronage of the International istitute of Agriculture in Rome.

12. A Congress must be summoned at least every five years by the Execu- ve Committee by arrangement with the International Institute of Agriculture Rome. All members of the Association shall be invited as well as persons ecially qualified in Soil Science who are not already members.

The Executive Committee will fix the place and date of the Congress ter consultation with the International Institute of Agriculture in Rome. In is connection it is necessary as far as possible to consider the wishes expressed the preceding Congress.

13. The scientific work of the Congress consists in the presentation of

reports, discussions, demonstrations and where desirable of the organisation of exhibitions. In addition the Congress has the following administrative duties:

(a) The consideration of the Report of the Vice-President on the work of the Association since the preceding Congress;

(b) The consideration of the Report of the General Secretary on the financial situation and also the report of the auditors and final approval of the accounts; election of auditors for the next financial period;

(c) Election of the President, Vice-president, two ordinary members, the General Secretary, the Librarian, the three auditors as well the remaining members of the General Committee, in so far as the Congress has power to make appointments.

V. — The Review.

14. The Review is published by the Executive Committee under the direction of the editor. The printing and publication is undertaken by the International Institute of Agriculture in Rome.

It will appear in separate numbers, forming an annual volume, beginning with January 1, 1925. It is a purely scientific review for original work in general soil science.

It also serves the following purposes:

(a) The establishment of as full a conspectus as possible of the most recent publications concerning soil science as a whole and kindred subjects.

(b) Abstracts of the most important recent publications.

(c) Publication of information relating to the activities of the Society in English, French, German, Italian and Spanish.

15. The Executive Committee will supply the editor with the staff and means to carry out his work. The Sections and Sub-Committees appoint their own assistants, whose business it is to collect the documentation and to publish information relating to the Society so far as it relates to the special work of the Section or Sub-Committee.

16. The members of the Society are entitled to receive the Review gratuitously after payment of their annual subscription.

VI. — Finance of the Society.

17. The funds of the Society are provided as follows:

(a) by the annual subscription of members, the amount to be fixed each year by the Executive Committee;

(b) by the amount of the subscriptions to the Review and advertisement charges, as well as by the sale of reprints and special publications;

(c) by voluntary contributions.

18. The Executive Committee decides as to the application of the funds and the General Secretary is responsible for finance.

19. The annual accounts must be closed at the end of the calendar year and forwarded to the auditors and returned by them to the Executive Committee within a month at latest. The accounts are wound up each year by the Executive Committee on the certificate of the auditors.

VII. — Other Regulations.

20. The Executive Committee has the right to settle all questions that not covered by the regulations as it sees fit and also to give decisions ıll doubtful cases as regards their interpretation.

21. Proposals as to alterations in the rules may be made by any member the A sociation, but must be sent in writing to the Executive Committee least three months before the Congress, and for their acceptance a two rds majority of the votes given is required.

22. The Society can only be dissolved after a vote taken on a report recom-nding dissolution and published in the Review at least a year before the vote taken.

The Society can only be dissolved if two-thirds of all the members are reed.

In the case of the dissolution of the Society the Executive Committee all decide in what way the funds of the Society shall be used for the fur-erance of Soil Science work.

Passed at the final meeting of the Fourth International Conference in ome on 19 May 1924.

The Committees of the International Society of Soil Science.

I. Committee for the Study of Soil Physics and Mechanics :

Chairman : Dr. V. Novak, Brno, Czechoslovakia ;

Vice-Chairm n : Dr. B. A. Keen, Rothamsted, Harpenden, England ; r. C. Davis, Washington, U. S. A. ; Prof. U. Pratolongo, Milan, Italy.

Secretaries : Dr. Krauss, Munich, Germany ; Dr. T. Mieczynski, ulawy, Poland ; Ing. J. Spirhanzl, Prague, Czechoslovakia.

II. Committee for the Study of Soil Chemistry.

Chairman : Prof. Dr. A. J. Alexius de Sigmond, Budapest, Hungary.

Vice-Chariman : Dr. B. Arnio, Helsingfors (Finland) ; Prof. Dr. M. M. acCool, East Lansing, Michigan, U. S. A. ; Prof. Dr. A. Vesterberg, Stock-aolm, Sweden ; Prof. Dr. G. Wiegner, Zurich, Switzerland.

Secretaries : Prof. Dr. Robert Ballenegger, Budapest, Hungary ; Prof. Dr. Norman M. Comber, Leeds, England ; Prof. Dr. Th. Saidel, Bu carest, Roumania ; Dr. E. Scherf, Budapest, Hungary.

III. Committee for the Study of Soil Bacteriology and Biochemistry.

Chairman : Prof. Dr. Ing. Julius Stoklasa, Prague, Czechoslovakia.

Vice-Chairman : Dr. Harold C. Christensen, Lyngby, Denmark ; Prof. Dr. H. Niklas, Weihenstephan., Germany ; Prof. Dr. Giacomo Rossi, Portici, Naples, Italy ; Dr. S. A. Waksman, New Brunswick, N. J., U. S. A.

Secretaries : Dr. D. W. Cutler, Rothamsted, Harpenden, England ; r. E. G. Doerell, Prague, Czechoslovakia ; Dr. Nemec, Prague, Czechoslo-vakia, Prof. Conn, New York ; Dr. Fred, Wisconsin U. S. A. ; Dr. Itano, Japan.

IV. Committee for the Study of Soil Fertility.

Chairman : Prof. Dr. Eilh. Alfred Mitscherlich, Kö igsberg, Prussia.

Vice-Chairmen : Dr. HARALD C. CHRISTENSEN, Lyngby, Den[illegible] Dr. K. ZYLSTRA, Groningen, Holland.

Secretaries : Dr. OLOF ARRHENIUS, Stockholm, Sweden ; Prof. [illegible] HOAGLAND, Berkeley, California, U. S. A. ; Prof. ASO. KOMADA, Japan.

V. Committee for Soil Nomenclature, Classification and Soil Map[illegible]

Chairman : Prof. C. F. MARBUT, Washington, U. S. A.

Vice-Chairmen : Dr. BENJ. FROSTERUS, Helsingfors, Finland ; Prof. [illegible] MURGOCI, Bucarest, Rumania.

Secretaries : Prof. A. TILL, Vienna, Austria ; Prof. W. WOLFF, Be[illegible] Germany.

VI. Committee for the Production of the Pedological Map of Eu[illegible]

Director : Prof. G. MURGOCI, Bucarest, Rumania.

Vice-Director : Prof. L. CAYEUX, Paris.

General secretary : Prof. W. WOLFF, Berlin, Germany.

VII. Committee for the Application of Soil Science to Scien[illegible] Agriculture.

Chairman : Oberst J. GIRSBERGER, Kultur-Oberingenieur, Zur[illegible] Switzerland.

Vice-Chairmen : Eng. E. GIOVANNONI, Rome, Italy ; Oberbaurat O[illegible] FAUSER, Stuttgart, Germany ; Prof. J. ZAVADIL, Brno, Czechoslovakia.

Secretary : Dr. Eng. RUD. JANOTA, Prague, Czechoslovakia.

Assessors : Prof. Dr. ZUNKER, Breslau, Germany ; Prof. LZESLAV SK[illegible] NICKY, Warsaw, Poland.

Report of the Progress of the Activities of the Organizing Committee of the Fifth International Congress of Soil Science. — At [illegible] meeting in November the American Society of Agronomy appointed Dr. C. F. MARBUT, Dr. A. G. MAC CALL and Dr. J. G. LIPMAN as members of the Organizing Committee of the Fifth International Congress of Soil Science. The Commitee, of which Dr. LIPMAN is Chairman, has been given power to appoint sub committees and to take such other steps as may be necessary toward establishing a satisfactory organization for the Firfth International Congress.

The Committee has planned a field excursion to enable the visiting delegates to become acquainted in the field with the soil formations and crop areas of the United States. It is expected that at least a month will be allowed for this excursion, which is to take place after the adjournment of the Fifth Congress. It is probable that the sessions will be held at Washington, D. C., late in May 1927, and that the field excursion will occupy nearly all of the month of June. If possible, the special train which will be made available for the delegates will travel as far as the Pacific Coast.

Efforts will be made by the American Committee to raise a fund sufficiently large to permit of reducing the expenses of the foreign delegates to a minimum. Steps have already been taken toward the organization of local committees in Washington, D. C. These will look after the comforts of the visiting delegates and the members of their families. Steps have also been taken toward the arranging for exhibits of soils, soil apparatus and general scientific apparatus

might be of interest to soil investigators. Considerable progress has made with the enrolling of members of the International Society of Soil ence. Local committees on membership are being organized.

J. G. LIPMAN.

I. Committee for the Study of Soil Mechanics and Physics. — Committee for the Study of Soil Mechanics and Physics was formed he occasion of the Second International Conference for Agricultural Geo- at Stockholm in 1910 as a Committee for the classification of the soil icles in connection with the mechanical analysis of soil. Its first chair- was Dr. ATTERBERG, late of Kalmar, Sweden. A general meeting of the mittee was held on 31 October, 1913 at Berlin and assumed the title of ommittee for the Study of Soil Mechanics and Physics ".

At this meeting proposals were brought forward by Dr. ATTERBERG to placed by the Committee before the next Congress for agricultural geology approval.

The following points were dealt with :

1. Classification of the Soil Particles.
2. Subdivisions of the different groups.
3. Preparation of the soil for mechanical analysis.
4. Viscosity apparatus.
5. Collections of the finest clay products.
6. Determination of humus.
7. International comparative analysis.

The Committee were agreed on the principles of the classification of the il particles as proposed by Dr. ATTERBERG and on the adoption of the AT- RBERG apparatus as the standard apparatus ; the lines of work in regard to e remaining points of the programme were laid down. See the decisions of the mmittee in the *Internationale Mitteilungen für Bodenkunde* IV, pp. 30 and 31.

As the international conference on soil science in Petrograd in 1914 never ok place, the approval of the decisions of the Committee had to be post- oned. International relations were broken off on the outbreak of war and e work of the first international Committee was thereby interrupted. The ork also suffered seriously from the death in 1916 of Dr. ATTERBERG who ad filled the office of chairman with distinction.

It was not till the third International Congress on Soil Science in Prague 922 that the Committee was once more re-established with M. KOPECKY of Prague as chairman. On the proposal of Dr. HISSINK the Committee carried ut comparative analyses in seven European laboratories on prepared samples f soil for mechanical analysis. The report on these analyses was made to the ourth International Congress on Soil Science in Rome in 1924 by the vice- hairman, Dr. NOVAK. At the final meeting of the First International Com- nittee it was decided to continue the comparative analyses in regard to soil samples prepared for mechanical analysis on four more typical soil samples and to make arrangements for holding the next international soil science con- gress in America. The question of standard apparatus for mechanical analysis was taken out of the programme. Members of the Committee were recommend-

ed to make a study of the methods of ascertaining [illegible] plasticity of the soil.

At the fourth international conference in Rome the following [illegible] from the Committee for the Study of Soil Mechanics and Physics :

Chairman Dr. V. NOVAK, Brünn, Czechoslovakia.

Vice-Chairmen : Dr. C. DAVIS, Washington, U. S. A. ; Dr. B. [illegible] Rothamsted, Harpenden, England ; Prof. Dr. S. ODEN, [illegible] Prof. U. PRATOLONGO, Milan, Italy.

Members : Prof. N. ALBERT, Eberwalde, Germany ; Prof. J. [illegible] Gorki, Russia ; Prof. BALLENEGER, Budapest, Hungary ; Dr. H. [illegible] rich, Switzerland ; Prof. A. de DOMINICIS, Portici, Italy ; Prof. [illegible] Gembloux, Belgium ; Dr. J. HISSINK, Groningen, Netherlands ; Dr. S. [illegible] SEN, Stockholm, Sweden ; Prof. P. KOETTGEN, Lich. b. Giessen, [illegible] Dr. LAITSIKAS, Athens, Greece ; Prof. H. LOUG, Berkeley, [illegible] Dr. E. RAMANN, Munich, Germany ; Dr. G. ROBINSON, Bangor, North W[illegible] Prof. Dr. K. ROERDAM, Copenhagen, Denmark ; Prof. Dr. A. J. de S[illegible] Budapest, Hungary ; Dr. L. SMOLIK, Brno, Czechoslovakia ; [illegible] Moscow, Russia ; Prof. P. VINASSA de REGNY, Parma, Italy ; Prof. C. [illegible] Parma, Italy ; Prof. T. WESTERMANN, Copenhagen, Denmark ; Prof. W[illegible] NER, Zurich, Switzerland ; Dr. J. P. van ZIJL, Stellenbosch, South Af[illegible] Prof. ZUNKER, Breslau, Germany.

The programme outlined at the Conference at Rome is being gradu[illegible] realised. The Executive Committee are organising further comparati[illegible] periments on the preparation of soil samples for mechanical analysis (see [illegible] the appeal to members of the first Committee) in conjunction with the [illegible] Committee, which makes use of the same soils for its comparative analy[illegible] A questionnaire was also prepared on the subject of the classification of [illegible] particles, thus carrying out the earlier programme of the Committee ; [illegible] classification will be introduced at an early date.

Dr. V. NOVÁK,
Chairman of the First Comm[illegible]

Request for Co-operation in International Comparative Analyses by Preparation of the Soil Samples for Mechanical Analysis. The [illegible] International Committee for mechanical and physical soil analyses [illegible] at the final sitting of the International Conference of Soil Science [illegible] on 16 May 1924 : " To continue the comparative researches in [illegible] institutions with different methods of preparation ". The object of [illegible] comparative analysis is the accomplishment of the work outlined in the [illegible] posal for the unification of methods to be followed in soil [illegible] experiment stations.

Tests are to be made of the following four methods of preparation :

1. *without chemical reagents* :

(*a*) agitation in distilled water by means of an automatic shaker with a horizontal motion.

(*b*) two hours boiling of the soil samples in distilled water [illegible]ed by repeated rubbing.

2. *with chemical reagents*:

(*c*) English von HISSINK modified method.

(*d*) ROBINSON method with hydrogen peroxide.

The institutions taking part are at liberty to investigate, if desired, other ...ods in addition to the above and to compare the results.

With this object the chairman of the Committee undertook to have four ...ge soil samples sent to every institution making application. The types ...il were: 1 tropical soil, 1 alkali soil, 1 acid mineral soil and 1 Rendzina containing lime and humus. Each institution is however recommended ...ake tests at the same time of other types of soil specially characteristic ...the environment.

The dimension of the soil particle is to be regarded as the most important ...t for comparison: its determination should correspond to 8 hours for time ...dimentation with 10 centimetres depth of liquid, at a temperature of 20°C. ... dimensions of the particles must in any case be determined: if other qual... have to be determined, the scale 0.2μ, 2μ, 20μ, 0.2 mm., 2 mm., is re...mended for the purpose.

The determination of the particles dimensions under the conditions stated ...ssential and should be effected on the basis of the sedimentation either by ...eated decantation or by the pipette method, etc. Any apparatus may be ...lied which is found to be the most suitable in the institution itself.

Each institution furnishes a report on the analyses carried out, to the chair...n's office of the First Committee, and all the reports are embodied in a me...randum. This memorandum is forwarded in good time before the beginning ... the Congress to all members of the Committee, so that they may make a ...dy of it before the meeting of the Congress.

The undersigned chairman of the International Committee for mechanical ...alysis permits institutions which are prepared to carry out analyses with soil ...mples prepared for mechanical analysis, to announce their readiness to co...erate up to the end of July 1925.

Average soil samples will very shortly be sent out, and precise and detailed ...structions, as to the methods as well as to the conditions which must be ob...rved in all cases for the comparative analyses will be added.

Up to the present date the following institutions under expert direction ...ave notified their intention of taking part in the work: Groningen (Dr. HIS...INK), Munich (Dr. RAMANN), Giessen (Dr. KOETTGEN), Breslau (Dr. ZUNKER) ...udapest (Dr. SIGMOND), Brünn (Dr. NOVÁK).

Dr. V. NOVÁK,
Chairman of the First Committee.

Address: *Brünn, Kvetna* 19 (Czechoslovakia).

II. Committee for Chemical Soil Analysis. — The first meeting ...f the International Committee for Chemical Soil Analysis took place at Munich on 23 and 24 April 1914, and a report was included in the *Internationale Mitteilungen für Bodenkunde*, Vol. V, 1915. After that date the events of the years 1914-1918 brought about a serious interruption of

the work. In 1922, however, at the Prague Conference, it appeared [illegible] able to re-establish relations between members of the Committee [illegible] the outcome of joint work it was possible at the Conference in Rome [illegible] to pass several resolutions, which may be regarded as definite steps [illegible] direction of establishing uniform analytic methods. These resolutions [illegible] to the question of the preparation of the hot concentrated HCl extract [illegible] well as the chemical determination of the substances assimilable by [illegible]

The separate resolutions are as follows: (*a*) for the preparation of the concentrated HCl. extract the method of BEMMELEN-HISSINK is in pr[illegible] adopted: only two questions in regard to the details of execution have [illegible] agreed upon viz. the quantity of the acid and the length of time requir[illegible] boiling. For the purpose of determining these points, the institutions w[illegible] express their willingness to take part in the enquiry will have several [illegible] of soil sent to them.

(*b*) The subject of soil acidity gave rise to lively discussion and [illegible] shown to be impossible to select a single method best suited to every [illegible] owing to the fact that the different methods of determination give diffe[illegible] indices of acidity. It is also proved that the acidity indices, although [illegible] afford a good indication of the lime requirements of the soil, can never g[illegible] information as to the quantities of lime to be applied. On this account it [illegible] resolved to keep separate the questions of the acidity indices and the lime [illegible] quirements. It is much to be desired that further work be done on this subje[illegible] Director HARALD R. CHRISTENSEN, Lingby, near Copenhagen, has undertak[illegible] the organisation of this work.

(*c*) As regards adsorption of bases the work of the Committee has [illegible] far advanced the problem that the possibility of devising a simple and [illegible] method of determining the exchangeable bases is becoming apparent. Dr. [illegible] J. HISSINK has undertaken the organisation of these researches.

(*d*) The question of the determination of the nutritive substances assi[illegible] milable by plants is one which is not yet sufficiently elucidated to allow the establishment of a simple method of determination to be contemplated. W[illegible] a view to expediting the solution of the problem a resolution for collaboration with the Committee for the study of soil fertility was passed.

(*e*) It was also proposed to appoint a sub-committee for the alkaline soils, but as this subject also comes within the province of the Committee for Soil Classification and Nomenclature, the chairman of the Second Committee has come to an understanding with Prof. C. F. MARBUT and a proposal has been made for organising this Committee as a sub-committee of the [illegible] Committee.

In concluding this short report on the position of the work of the Commit[illegible] tee it is satisfactory to note that the number of members, which at the time of its formation in 1910 was ten only, has now reached 64. The list of members is as follows:—

Chairman: A. A. J. VON S'IGMOND, Budapest.

Vice-Chairmen: B. AARNIO, Helsingfors; M. M. MACCOOL, East Lans[illegible] ing, U. S. A.; K. A. VESTERBERG, Stockholm; G. WIEGNER, Zurich.

Secretaries: R. BALLENEGGER, Budapest; N. M. COMBER, Leeds; [illegible] AIDEL, Bukarest; E. SCHERF, Budapest.

Members: J. J. ALWAYS. St. Paul, U. S. A.; G. ANDRÉ, Paris; E. BILL-. Copenhagen; H.R. CHRISTENSEN, Lingby; K. DANIEL, Munich; J. DANZL, ·h; D. DIGENTY, Budapest; C. DUSERRE, Lausanne; A. FLODERER, Ma-vár; R. GALLAY, Morges, R. GANSSEN, Berlin; G. GAROLA, Chastres; OITZ, Nosoff; H. GESSNER, Zurich; L. GILE, Washington; A CH. GIRARD, ; K. GLINKA, Leningrad; A. GREGOIRE, Gembloux; St. HAYDIN, Ina-kucs; A. HERKE, Szeged; D. J. HISSINK, Groningen; H. JENNY, Zurich; , New-Jersey; A. F. JOSEPH, Khartoum; H. JUNK, Munich; KYAS, n; M. H. LAGATU, Montpellier; O. LEMMERMANN, Berlin; J. G. LIP-New Jersey; A. MENOZZI, Milan; E. MITSCHERLICH, Königsberg; . NEWMAN, Cambridge; B. NIKLEWSKI, Posen; E. NYIREDI, Budapest; LSEN, Lingby; J. PETERSEN, Ladelund; E. RAMANN, Munich; N. REIT-R, Vienna; N. RITTER, Bern; J. ROSSI, Portici; E. J. RUSSELL, Rothamsted; ALACZ, Budapest; H. SALLINGER, Munich; B. SCHMITZ, Oerlikon bei Zu-O. SCHREINER, Washington; L. SMOLÍK, Prague; H. STREMME, Danzig; EMIAN, Angora; O. TAMM, Alnarp; F. TERLIKOWSKI, Poznau; G. TOMMASI, ne; R. TRNKA, Prague; A. VENDL, Budapest; W. VERNADSKI, Leningrad; ZOEHLS, Budapest.

(*Signed*) A.A. J. VON S'IGMOND, *President of II Committee.*

R. BALLENEGGER. *Secretary of II Committee,*

Circular of the Second International Committee for the Study of l Chemistry on the question of the Preparation of Hydrochloric d Soil Extracts. — At the Fourth Congress on Soil Science at Rome Second Committee passed the following resolution on the preparation of lrochloric acid soil estracts.

" Before deciding finally on the adoption of the BEMMELEN-HISSINK, cess it is advisable to ascertain:

" 1. If the respective quantities of the soil and of the acid should be those ressed by the figures 1 gm. of soil and 25 cc. of acid, or if the quantities responding to the figures 1 gm. of soil and 10 cc. are sufficient.

2. If a boiling for one hour is not enough instead of prolonging the boil-; for two hours.

" To decide these two points it is necessary to make special experiments samples of fine earth of various soil types, at least three kinds: acid, neutral d alkaline. »

" Members engaged in research work who desire to take part in this in-stigation are asked to address the chairman of the Second Committee, Prof. exius A. J. VON SIGMOND, Budapest, Hungary, 1 S'zent Gallért tér 4 ".

Members of the Committee who wish to take part are accordingly asked to it themselves in touch with members of the First Committee for the taking oil samples. These samples will be forwarded on request to the chairman the Second Committee. Members of the Committee are informed that in der to save carriage the investigations proposed by the First Committee for e Study of Soil Mechanics and Physics will be made on the same samples.

As regards the preparation of the acid extract, members are reminded that

the original proposal made to the Congress by the Chairman of the Sub-committee was in the following terms:

(a) 10–25 gm., of the soil sample are set to boil rapidly in an open flask on a naked gas jet with the addition of 25 times the volume of HCl of a concentration of 25·35 %, by weight, till the boiling temperature is reached. The time necessary should not exceed 25 minutes and can usually be reduced to 15 minutes. A reflux condenser is then placed on the flask and boiling on the gas jet is continued without interruption for two hours precisely. After two hours boiling, cold water is quickly introduced and the insoluble part is allowed to settle. Then the clear solution is decanted and the process repeated till the reaction of the filtered solution is only slightly acid. In this solution the content is usually determined of SiO_2, Al_2O_3, Fe_2O_3(MnO_4), CaO, MgO, Na_2O and P_2O_5.

(b) To remove from the insoluble precipitate the last remains of acid a small quantity of Na Cl, is added and the lixiviation by decantation is continued until the reaction of the filtered solution is completely neutral. The insoluble residue is then dried over a water-bath, the filter paper with its considerable contents is reduced to ashes and added to the insoluble residue. In this latter process the colloidal SiO_2 may lose something of its solubility in dilute alkali. To avoid this result care must be taken that only a very small quantity of the insoluble residue from the decantation reaches the filter paper. To dissolve in alkali the soluble SiO_2, it is shaken or stirred for five minutes at a temperature of 55°C. in an ERLENMEYER flask with 200 mm³ of KOH of ... specific weight. After five minutes cold water is poured into the flask and lixiviation proceeds with decantation as before, until there is no alkaline reaction, i. e. when there is finally added a small quantity of NaCl. In the course of the alkaline dissolution the percentage of SiO_2 is determined and, if possible, also Al_2O_3 and other bases.

We are of opinion that it is sufficient to determine the quantity of SiO_2 soluble in the alkali and in the acid extract and to determine the total sesquioxides (Fe_2O_3, Al_2O_3) by precipitation in a warm solution of ammonia.

The detailed account of the method to be followed with the soil samples will be sent later.

Members are free to carry out also the determination of the other constituents or to try another process for the preparation of the acid extract, but in any case they are asked to carry out the determinations described.

Collaborators are asked to make their requests for soil samples before September 1925.

Prof. Dr. ROBERT BALLENEGGER,
Secretary of the Second Committee.

Prof. Dr. A. A. J. VON SIGMOND,
President of the Second Committee.

Sub-Committee for Alkali Soils. — The problem of the alkali soils is a world-wide problem, and its solution can be reached only with the collaboration of all who are working at the subject. Co-operation in the work of the Alkali Sub-Committee is therefore asked. The first step is to lay down the programme, and it will be helpful to receive a list of questions which it is felt should be made the subject of an international

... It is recognised to be a great drawback to the work that the ...s of the alkali soils made in the different countries are not compa... owing to the employment of widely differing methods. It appears it would be advantageous to work out standard methods and ...ression of opinion as to which methods should be adopted would be ...ued. The Second Committee for the Study of Soil Chemistry is working ... method for the digestion of soils with hydrochloric acid (method ...ELEN-HISSINK) and this method might possibly be employed also in the ...f the alkali soils. There is also the question of the terminology of the ... soils, and it is felt that the knowledge of these soils would be advanced ...ry worker would give a description of the whole profile of the soil. ... agreement as to terminology would be necessary here.

...t is considered also that it would advance the question of the reclamation ...ali soils if experiments on the same plan could be made in different parts ... world. But before undertaking this work on a large scale, it is important ...ther all the available data on soil surveys in alkali districts.

...Any suggestions that may be made on this subject will be very ...table.

... ROBERT BALLENEGGER, *Secretary*, Prof. A. A. J. VON SIGMOND, *Chairman*,

Alkali Soils Sub-Committee.

III. Committee for Soil Bacteriology. — A date early in July for ...eting of the Committee in Berlin will be fixed after consultation with the ...rman, Prof. STOKLASA.

IV. Committee for the Study of Soil Fertility. — No report has appeared.

V. Committee on the Nomenclature Classification and Mapping Soils. — Prof. C. F. MARBUT, Washington, U. S. A. (Chairman).

Sub Committees.

(1) Sub-Committee for Eurasia on the Nomenclature and Mapping of ...ls:

Dr. B. FROSTERUS, Finland (Chairman); Dr. D. K. GLINKA, Russia; ... S. MIKLASZEWSKI, Poland; Dr. H. STREMME, Germany; Prof. L. CAYEUX, ...nce; Dr. O. T. TAMM, Sweden; Prof. W. WOLFF, Germany; Prof. V. NO...RESE, Italy. The committee will be still further enlarged by appointments ...de by the Chairman.

(2) Sub-Committee for Eurasia on the Mapping of Soils.

Prof. G. MURGOCI, Roumania (Chairman); Prof. W. WOLFF, Germany (Ge...ral Secretary); Prof. L. CAYEUX, France (Treasurer); Dr. B. FROSTERUS, ...land; Dr. D. K. GLINKA, Russia; Dr. S. MIKLASZEWSKI, Poland; Dr. H. ...REMME, Germany; Prof. PETER TREITZ, Hungary.

Additions to the membership will be made by the Chairman.

(3) Sub-Committee for the Americas on the Nomenclature and Classi...ation of Soils.

Prof. C. F. MARBUT, Washington, U. S. A. (Chairman); Dr. P. E. B. Ames, Iowa, U. S. A.; Prof. M. L. MILLER, Columbia, Missouri, U. Dr. F. J. ALWAY, St. Paul, Minnesota, U. S. A.; Prof. A. R. Whitson, Madison, Wisconsin, U. S. A.; Prof. G. W. CONREY, Columbus, Ohio, U. Prof. C. F. SHAW, Berkeley, California, U. S. A.; Prof. W. L. Powers, Corvallis, Oregon; U. S. A.; Prof. J. G. HUTTON, Brookings, South Dakota, U. Prof. H. L. WALSTER, Fargo, North Dakota, U. S. A.; Prof. A. L. Patrick, State College, Pennsylvania, U. S. A.; Prof. L. F. GIESEKER, Bozeman, Montana, U. S. A.; Dr. M.M. McCOOL, East Lansing, Michigan, U. S. A.; Prof. R. S. SMITH, Urbana, Illinois, U. S. A.; Prof. H. O. BUCKMAN, Ithaca, New York, U. S. A.; Prof. A. W. BLAIR, New Brunswick, New Jersey, U. S. A.; Dr. CONDRA, Lincoln, Nebraska, U. S. A.; Mr. J. F. STROUND, Montgomery, Alabama, U. S. A.; Prof. L. M. CARTER, Athens, Georgia, U. S. A.; Prof. W. COBB, Chapel Hill, North Carolina, U. S. A.; Dr. G. S. GRAPS, College Station, Texas, U. S. A.; Prof. G. N. RUHNKE, Guelph, Ontario, Canada; Mr. HAWKINS, Saskatoon, Saskatchewan, Canada; Dr. AVELINO I. de OLIVEIRA, Rio de Janeiro, Brazil; Mr. Horace WILLIAMS, Rio de Janeiro, Brazil; Director Juan R. MONTES DE OCA, Buenos Aires, Argentina.

(4) Sub-Committee for the Americas on the Mapping of Soils.

Mr. J. W. MCKERICHER, Washington (Chairman); Mr. F. J. MARSCHNER, Washington; Prof. C. F. MARBUT Washington; Mr. T. D. RICE, Washington; Mr. W. E. HEARN, Washington; Mr. H. H. BENNETT, Washington; Mr. M. LAPHAM, Washington; Mr. M. BALDWIN, Washington; Prof. A. H. J. Saskatoon, Canada; Prof. G. N. RUHNKE, Guelph, Canada; Dr. AVELINO DE OLIVEIRA, Rio de Janeiro, Brazil; Director Juan R. MONTES DE OCA, Buenos Aires, Argentina.

This list will be completed later by adding names for Mexico, the States of Central America and of the other countries of South America.

Report of the Work of the Committee for the Agro-Geological Map of Europe, 1924. — In accordance with the resolutions of the Fourth and Fifth Committees on the International Agro-geological Conference at Rome on May 1924, a Committee has been formed for the preparation and publication of an international pedological map of Europe on the scale of 1 : 2½ million as well as of the separate European countries in 1 : 1½ million. The headquarters of this Committee is Bucarest (W Soseaus Kisseleff 2), the chairman Prof. MURGOCI, the vice-chairman, Prof. CAYEUX in Paris, the Secretary Prof. WOLFF in Berlin, and members of the executive, Prof. FROSTERUS in Helsingfors, Prof. GLINKA in Leningrad, Prof. von MIKLASZEWSKI in Warsaw, Prof. STREMME in Danzig and Prof. TREITZ in Budapest.

The first business of this Committee was the issuing of directions for uniform construction of the maps in the different countries. These directions have been very carefully drawn up by Prof. MURGOCI and brought out by Prof. TILL in Vienna under the title: "Instructions pour la préparation de la Carte Générale du sol de l'Europe" and forwarded to the individual members. It is proposed to send as supplementary aids to work a dictionary of technical terms in soil science in the languages concerned and a specimen map of the Rumanian plain and the Northern Dobrudscha, but these have not as yet reached the members.

the death of Prof. MURGOCI, who had devoted himself unreservedly to ›rk, the Committee has sustained a severe loss; it is now important, l the preliminaries should be concluded, so that the coming summer fully utilised for the field work which is to be carried out in each coun-

regards work in Germany, a petrographic representation of the German . the principle of the international geological map is being prepared, and ›ments are in progress for a purely pedological survey of the country the summer.

W. WOLFF.

I. Committee for the Application of Soil Science to Scientific ulture. — A report will appear in the next issue of this Review.

›ersonal.

G. M. MURGOCI,
GEOLOGIST IN CHIEF,
CHIEF OF THE SECTION OF THE RUMANIAN
GEOLOGICAL INSTITUTE,
PROFESSOR OF THE BUCAREST POLYTECHNIC SCHOOL,
CORRESPONDING MEMBER OF THE RUMANIAN ACADEMY,
›RRESPONDING MEMBER OF THE FRENCH ACADÉMIE D'AGRICULTURE,
CHAIRMAN OF THE INTERNATIONAL COMMITTEE
ON SOIL MAPPING AND DIRECTOR
OF THE PEDOLOGICAL MAP OF EUROPE, ETC.,

at Bucarest on 5 March, at the age of 53 years.

An obituary notice will appear in the next issue of this Review.

Prof. R. GANSSEN, Divisional Director of the Prussian Geological Provin- nstitute in Berlin and Director of the Pedological Laboratories celebrated oth birthday in March.

Dr. SOKOLOWSKY, of the Agricultural Institute at Kharkov, was appointed ıgust 1924 to the Executive Committee of the Soil Science Research Bureau, rofessor at the Agricultural Institute, as well as member of the Scientific mission for Ukrainian Agriculture.

Errata.

In the article "Ein Beitrag zur Charakt. der Hannaböden" von V. ÁK,, published in *Internat. Mitt. f. Bodenkunde*, XIV, H. 3-6, under the tration on p. 95, read Fig. 3 instead of Fig. 2, and on p. 103, Fig. 2 ıld be substituted for Fig. 3.

SPECIAL ACTIVITIES
OF THE BUREAU OF AGRICULTURAL SCIEN[CE] OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

ENQUIRY ON LOCUST CONTROL.

LOCUSTS IN HUNGARY DURING 1924 [1]

HISTORICAL NOTE.

The locust invasion of 1924 was a continuation of that of 1[923].
The Italian cricket (*Calliptamus italicus*) appeared, as us[ual,] earlier than the Moroccan (*Dociostaurus maroccanus*). It was [re]marked from the first that, in those areas where systematic [and] scientific control had been established in the preceding year or wh[ere] the locust parasite *Empusa* had then occurred, the locusts eith[er did] not appear at all in 1924, or only in quite small numbers. It [is a] curious fact that the fatal effects of the *Empusa Grylli* are ent[irely] local. Thus in 1924 in Szaszberek (commune of Ujszász, Ko[unty] of Jásznagykunszolnok), the following observations are made. Th[e] farm areas which still include, even since the carrying out of t[he] agrarian reform, several thousand Hungarian 'yokes', were [] infested in 1924 by the Italian cricket, although in 1923 a very s[e]rious invasion of this species had occurred, especially attacking [] lucerne, and had subsequently, towards the end of July and d[uring] the month of August, been severely infected by the fungus alre[ady]

(1) This report, comunicated by the Royal Hungarian Ministry of Agricultur[e], [] up so as to follow on that of the previous year and at the same time [] the [] enquiry made by the International Institute of Agriculture. For the terminology [] to and the scientific names of the different kinds of locusts, compare the report [] which appeared in the *International Review of the Science and Practice of A[griculture]*, [] Series, Vol. II, No. 2, April-June, 1924: pp. 464-470.

ioned. On the contrary, in the areas which had not suffered the Italian cricket in the preceding year and were attacked for the first time in August by newly arrived swarms, the species ared in large numbers in 1924.

This phenomenon was noticeable not only on a small scale, or hamlet covering some thousand 'yokes', but also on a large : whole groups of communes, which had been completely ted the year before, and where, though control had been very ectively carried out, the *Empusa* had occurred, were entirely free the Italian cricket in 1924. On the other hand localities which been completely free from the parasite in 1923 suffered very rely in 1924 from the locusts.

It should be noted that the appearance of the *Empusa Grylli* in was first remarked on 1 July, whereas in 1924 it was somewhat ier. In 1923 however the development of the Italian locust was ewhat retarded, and the attacks of this *Entomophthores* thus cted the second larval or the first nymphal stages. In other words locusts were only in the middle of their development cycle, and to the end of September and later, the infection went on spread- to such an extent that on the tops of the lucerne or of the thistles *rduus nutans*) and any other tall stiff weeds, quite large clumps of d locusts could be seen. In such a clump there would be found ie young and some old locusts both male and female, bleached by 1 and sun.

In 1924 the attacks of the *Empusa* were considerably more se- e and areas not previously attacked by locusts were affected. this season the dead dried locusts could be collected in sackfuls.

No eggs had been laid by the locusts thus attacked, and by eated investigation it was ascertained that, while the development the eggs in the ovaries of the females had begun quite normally, l pairing had taken place, the eggs while still in the mother's body l become decomposed and reduced to a liquid state, and in a short ie the interior of the locust was completely penetrated with the celium and choked with spores, or the surface of the body, par- ularly the delicate membrane connecting the joints of the abdomen, is entirely covered with the spores of the fungus, which at first were a whitish colour and then gradually turned brown.

It should be noted that in spite of the severity of these attacks *Empusa*, there remain wide tracts where the Italian locust ap- ared in large numbers and laid its eggs over considerable areas.

In 1924 on 22 July in the Commune of Tiszacsege (K... *Komitat*, Hajdu), where great damage had been done to the ... crops by this locust, the writer was able to observe that pair... egg-laying were in progress to an unusual extent over extraordi... large areas. It may be mentioned that in 1924 the damage to the tobacco crops by locusts was exceptional and, apart fro... case just referred to, a large number of most promising to... plantations in the commune of Püdszentmihály (*Komitat* of ... bolcs) were ravaged by the Italian locust. It was not merely a... where as usual the lower older leaves were attacked, nor eve... the finest leaves being riddled with holes as occurs if locusts... feeding: in this season on whole plantations nothing was le... the plants but the bare stems with a few young leaves on the... The damage done to the favourite food plants of this locusts, ... cerne and 'Mischling', a mixed sowing ofve tch, oats and barl... though in any case considerable, was perhaps on the whole in ... year under report perceptibly less than in the preceding year.

It was even more noticeable in 1924 than in previous ye... that the lucerne fields of four years growth or more, suffered m... severely than other areas where the growth of herbage was lower... less close, as in pastures and meadows, or on banks of canals a... dykes.

No other observations of any importance were made.

The communes attacked by locusts of this species, as well ... by the Moroccan species, are enumerated in the annexed table.

The Moroccan locust appeared in 1924 in the same localities ... were attacked in 1923. No new observations were incorporated ... the report for this only too well known locust.

It appeared on various large pastures, first on small patches a... in inconsiderable numbers, and, as usual, little attention was ... first paid to it. The areas attacked however became larger a... merged into each other and the little 'hoppers' soon became ... threatening swarm of all devouring locusts. Even in 1924 man... communes did not ask advice in time, for the locusts on develop... their wings deserted the arid pastures from which they had eaten every green blade and threw themselves upon the wheat fields. In consequence of this neglect at the earlier stage, from two to three thousand "yokes" of wheat were sacrificed. The greatest damage was done in the commune of Pély (*Komitat* of Heves), where the Moroccan locust has had for more than twenty years a breeding

e and is hence well known to the population on account of its
ted depredations.

An observation was made this year in regard to the development is species of locust, viz. that any retardation in one phase is ensated for by more rapid development in the other phases. as noticed for the first time that the Moroccan locust emerged the ground at the end of April (27 April), and from the mid-of June (10 June) became winged, its full development thus reached in 44 to 45 days. In many seasons the young only the ground in the first ten days of May or even on 13 or 14 : the first winged locusts however appear almost always on 10 I June, which shows that the complete development may take e in these cases in periods varying between 28 and 38 days. Now ay happen that within the extreme limits of the period of de-pment the locust may, so to speak, lag behind in one or other, etimes in several, stages of its development, whether in the larval e or that of the nymph, so that instead of taking 5 or 6 days ly double that time is spent, before it reaches the next stage. ight be supposed that in such a case the whole period of the de-pment of the locust would be so much longer. This however ot so, for when one or more phases are extended the successive ges up to the final transformation into the winged creature are espondingly shortened.

This circumstance originally misled the organisers of the control asures, and is still every year a source of miscalculation on the t of the threatened population. To it is no doubt due the t that control is more or less unsuccessful, as the delay in de-opment is apt to encourage the idea that there is more time for ting the measures into practice, an idea invariably contradicted the facts. On 10 to 11 June the first winged locusts always ap-ar and become from day to day more numerous and about 29 ne (the feast of SS. Peter and Paul) which is in Hungary ac-ding to the widespread popular idea the first day of harvest), ere are often more vigorous swarms of flying locusts than ever, ich in the days that follow become even more active and dan-rous. It is from facts like these that one sees why any half asures at the beginning of control work out their own punish-ent before the end of the campaign, even in localities where it ight be assumed that the population would have to be careful, if t on account of the damage to others, at least for their own sakes.

PERMANENT CENTRES OF INFECTION BY ITALIAN AND M[illegible] CRICKETS "CALLIPTAMUS ITALICUS" AND "DOCIOST[illegible] MAROCCANUS".

The writer is of opinion that, though the chief and or[illegible] egg-laying centres of the locust are to be found in all the Medi[illegible] nean countries both North and South it has been for a long time [illegible] lished in Hungary and certainly earlier that the Moroccan spe[illegible] Soil conditions in Hungary are more favourable for the Italian [illegible] the Moroccan cricket, the latter being specifically an inhabit[illegible] salt lands.

The Italian cricket has been found throughout Hungary [illegible] the beginning of the twentieth century. In the mountain areas [illegible] as the Siebengebirge and Transylvania and also to the South of [illegible] Carpathians on the hills bordering on Pannonia, the cricket is [illegible] seen at intervals though frequently in undesirably large quanti[illegible] Large numbers are only to be found in the warm and too aften [illegible] plains of the Alföld bordering both banks of the Tisza. In all [illegible] vast region it has however been impossible to identify more than [illegible] permanent egg-laying areas. The more northerly, which [illegible] be called the infection area of Mátra is situated on the south east[illegible] slope of the Mátra mountains in the area bounded by the Tarna [illegible] Laskó streams, its central point being in the Communes of Ald[illegible] Nagytálya, both in the *Komitat* of Heves. The second is the R[illegible] Tisza breeding ground lying to the South East of the former [illegible] extending on the left bank of the river over Tiszafüred, Tisza[illegible] (both in the *Komitat* of Heves), Tiszaszentimetre, Tiszabud, Tisza[illegible] Tiszabüra, Tiszaroff (in the *Komitat* of Jasz-Nagykunszolnok) [illegible] on the right over Tiszasüly and Kötelek (in the *Komitat* of Jasz[illegible] gykunszolnok).

The fact that for over 40 years the Italian cricket has alwa[illegible] not only made its first appearance but also is found in these reg[illegible] in enormous numbers is in the author's opinion sufficient proof th[illegible] they are the real centres of infection. Even though the adjace[illegible] districts are as a rule the first to be attacked from this source th[illegible] does not prevent the locust from increasing disastrously in mo[illegible] distant areas, where they always breed though less extensive[illegible] This consideration must always be borne in mind in the future fro[illegible] the point of view both of prevention and control.

On the other hand it cannot be said that there are in Hungary permanent centres of infection by Moroccan crickets and the earance of this species is of more recent date.

JOH. VON FRIVALDSZKY, the author of a study of the Hungarian ioptera (1) refers to the *Dociostaurus* (Stauronotus) *brevicollis*, ecies very similar to the *D. Maroccanus* Thb. and states that this cies is smaller than *S. cruciatus* Ch., the true Moroccan cricket, ch he also describes. FRIVALDSZKY himself with his colleagues the National Museum of Hungary had at the time surveyed the ole country and collected considerable numbers of specimens of hoptera in the districts in which *D. Maroccanus* Thb. *cruciatus* rp. had periodically caused great damages since 1880. They vever found no trace of the Moroccan cricket in these districts or any other part of Hungary.

BRUNNER VON WATTENWYLL also makes no mention of the stence of this species in Hungary, though in his book (2) he gives description of it and an account of its geographical distribution. however informed Dr. GEZA VON HORVÁTH by a written communition dated 1 November 1920 that he had found specimens from 1862 wards in the neighbourhood of Báziás on the left bank of the Dabe on the confines of Old Hungary and Serbia, along the boundary ies of the *Komitats* Torontál and Krassó-Szörény. He also states at this species is to be tound in Serbia according to information ceived from that country.

The first destructive invasion by the Moroccan cricket in Hungary ok place in 1899 in the *Komitat* of Torontál which at the present me belongs to Yugo-Slavia, and in this area its ravages continued ll the end of 1921. In the following years the infested area was vided up into allotments and brought under cultivation. For is reason the writer found in the summer of 1905 a small area only hich could be described as dangerous as a possible centre of infection, lthough the species was still existent in a sporadic state. He is onfident that this was the first infection centre for the Moroccan ricket in Hungary and that it has now been destroyed.

About the same time this insect caused damage in the neighourhood of Szegd and in the surrounding *Komitat* of Csongrád, but

(1) FRIVALDSZKY JÁNOS, A Magyarországi egyenesröpüek magánrajza (Monographia Orthopterorum Hungariae). Pest, 1867, p. 1612.

(2) BRUNNER VON WATTENWYLL C., Prodromus der Europäischen Orthopteren, p. [illegible]. Leipzig, 1922.

the losses caused were slight and the development of cultivat
put an end to the trouble.

The breeding place, which has continuously since 1904 se
a permanent source of diffusion, is situated farther North b
the Communes of Jászkisér in the *Komitat* of Jászmagykuns
Pély in the *Komitat* of Heves and, in a southerly direction, b
Bessenyszög and Nagykörö in the *Komitat* of Borsod. Th
writer describes as the Jazygier breeding ground. From thi
the insect passes in a North Easterly direction, first by Tis
in the *Komitat* of Heves and then to the area between Mező
and Emöd in the *Komitat* of Borsod where it forms a small be
sistent breeding ground which is constantly renewed. This
tion centre is the origin of invasions in another direction, pass
Tiszafüred but extending further eastwards. The swarms sett
the extensive natural pastures of Nagyhortobágy near Debrece
also find in the neighbourhood another district of pasture land
an area of over 120,000 cadastral " yokes ", forming a uniform
marching with that of Nagyhortobágy, where a large infection
tre is formed. Northwards the extreme limits of attack are Buds
mihály in the *Komitat* of Szaboles, southwards, Dévaványa in
Komitat of Jásznagykunszolnok, in the West, Tiszafüred in the
mitat of Heves, in the East, Balmazujváros in the *Komitat* of H
This breeding ground however has up to the present, despite
large extent, only proved of secondary importance. It is impos
however to state that it will always remain so, for on one occa
it was the source of a particularly extensive invasion lasting fo
three year period between 1905-1907. The future will show whe
there will again be a similar outbreak and how serious. It sh
however be noted that the pasture lands of Nagyhortobágy and ne
bourhood have again been invaded for the whole period between 1
and 1924 by the Moroccan cricket, but to so small an extent an
sporadically that so far it has not been necessary to institute any
finite system of control.

The appearance of this species in Hungary is recorded in
statement to be found in the appendix.

In 1923 another variety of locust, *Orphania denticauda* Ch
appeared in Hungary and was a fresh cause of anxiety (1). It w
also observed again in 1924, practically in the same districts as
the previous year but only in small numbers elsewhere (see appen
and also in Slovakia, from which the writer received specim

ked as ' migratory locusts '. In Hungary this species has not ı considered a serious danger, for the inhabitants of the area atened knew by experience of the previous year that the insect not particularly dangerous.

The ash grey migratory locust ' *Locusta danica* L. *Pachytylus icus et cinerascens auctorum* ' made its appearance this year in same areas as in the previous year (1). It appears to show a lency to multiply in the areas that were attacked in the previous r, where only 170-200 specimens had been collected with great iculty, whereas it was to be found by thousands in 1924. The nber of communes affected has also increased, not only in Hungary also, as shown by the detailed report annexed, in part of the *Ko-at* of Bereg, which lies in Slovakia across the frontier. The writer vever is of opinion that this species does not constitute any parti-ar danger. In the first place this locust, though strong and des-ctive, is when compared with others comparatively innocuous. condly their breeding places, swamps damp meadows and unculti-ed lands, are of small extent in the district where they were found the previous year, and all the surrounding area has for a long time en under permanent cultivation.

In 1924 however it was discovered that a species of prairie asshopper, a locust in the original sense of the name, which had herto been considered to be harmless, was capable of becoming ngerous in certain conditions. In the areas attacked partly by e Moroccan cricket, for example, Karcag in the *Komitat* of Jász-gykunszolnok, and partly by the Italian cricked (for example, ászberek in the same *Komitat*), certain *Chelidoptera* (*Platycleis*) peared, and amongst these the *Ch. albopunctata* Goëze (*Pl. grisea*) ıb.) was the cause of serious damage.

It should be stated that in Hungary several varieties of these *helidoptera* are found and that if the true dangerous locusts appear large numbers the native grasshoppers are also as a rule very nu-erous. They however remain harmless and live and spend all ıeir time in the pasture lands. Occasionally however they have ıown themselves in the wheat and barley fields after harvest, here they find a lodging in the sheaves which are known in Hungary Kreuz. These insects which were at the perfectly mature stage at mes collected in large numbers and devoured the grain in the ear. For

(1) See *Inter. Rev. of Sc. and Practice of Agric.* Vol. II (1924), No. 2, p. 465 and ibidem, p. 467-46[illegible].

this reason the *Platycleides* are known in Hungary as the 'ha that eat the corn ears'. The damage done however has considerable. In 1924 however various kinds of cereals, esp wheat and barley, while still in the green stage, were attack by the adult insects but by the nymphs and larvae. As they only ate the grain when still in the milky stage but to su extent as to bring about a loss of nearly 100 per cent.

On investigation of this new phenomenon it was clear th cattle of the pasture lands were the ultimate cause of the tr as they gradually forced the *Platycleides*, while still in the imm stage to leave the pastures so that they settled on the neighbo crops. As this process of expulsion lasted for several weeks, end the 'hoppers' were found to have disappeared entirely from pastures to find a lodging among the cereal crops. Frequently confined their depredations to the borders of the fields, but o casion they penetrated as far as 100 or 200 paces from the e leaving their mark on each ear, and in many cases consuming grain in the ear. Control of these 'hoppers' in a cornfield is im sible, and they cannot be hunted out like true locusts. They from the ears in among the corn and conceal themselves on ground. The only thing to be done is to harvest the field as qu as possible in order to save what remains.

The pasturing cattle may in the same way oblige the Ita and Moroccan crickets to take refuge in the cereal crops, but as gards the Moroccan species up to at least 50 % to 60 % can driven out again if sufficient care and patience are exercised. It often happens that this cricket abandons the corn field of its accord after a short stay, and thereupon can be exterminated w out difficulty. This is however far from being the case with the P *tycleides.*

Locust Control, its Practical Results and Outlook for Future.

The sole alteration made by the State authorities in the orga sation of the control measures, necessitated by the widespread dam was that the control of the Italian crickets was to be organised a directed by the communes themselves, and that the necessary pense must also be met locally. The measures against the Morocca cricket were organised and directed by State experts, the salaries

ie experts, and the railway transport of the control apparatus, hines, etc., paid by the State, but the actual labour, including plies as well as wages, defrayed by the communes. A proposal submitted to the Hungarian Parliament at the end of 1924 for alteration of the Landgesetz (agrarian law) No. 31 of the year 7, as also of the ancient custom in this respect.

The control measures remain the same as in 1923, and on the le have given satisfactory results, except, as has already been said, ne commune, Pély (*Komitat* : Heves), where very considerable nage was caused by the Moroccan cricket, in consequence solely local negligence and procrastination. The damage thus done to 000 " yokes " in itself represents at the present wheat prices (be-ning of 1925) a loss of 5 to 7.5 millions of Hungarian crowns has been noted that the successful campaign of the preceding year tially ensured the success achieved in 1924 and that the *Empusa* locust fungus did much to contribute to the destruction of the lian cricket.

A strict estimate of the Government expenditure in 1924 was 0 million Hungarian crowns (paper) ; it was impossible to estimate e cost to the communes.

As regards the work to be done in the future, the first essential that the people themselves should be thoroughly and unceasingly structed as to the different kinds of locusts and the method for their ntrol : in the second place that all administrative provisions should om the very first appearance of the locusts be put into force d carried through, so that a thorough control may be exercised er the young locusts and over small affected areas. But this is only ssible if the organising authority can act on its own initiative and s the necessary means at its disposal, if the control measures are gorously carried out and the officers in charge are in their places ay in and day out, and thus all available forces can be utilised at e right moment.

The Royal Hungarian Ministry of Agriculture has issued control structions for the information of the population threatened by cust invasions. Two publications have appeared ; the first gave a urvey of the present situation as regards locusts with an account of e appearance of the different kinds and a statement of the rules to e followed in the campaign against the danger. The second contains n announcement of the preliminary measures proposed. The author of this publication is the writer of this report.

Detailed Information regarding the Locust Invasion during 192[illegible] in H[illegible]

No.	Communes	Komitats	Moroccan Crickets	Italian Crickets	[illegible]
1	Gagybátor	U. Akauj		+	
2	Felsökázsmárk	»		+	
3	Pusztaszikszó	»		+	
4	Gyoma	Békés	+		
5	Szeghalom	»	+		
6	Békéssámson	»		+	
7	Füzesgyarmat	»		+	
8	Mezöberény	»		+	
9	Vésztö	»		+	
10	Gyula	»		+	
11	Bucsatelep	»		+	
12	Békés	»		+	
13	Gyulavári	»		+	
14	Doboz	»		+	
15	Báránd	Bihar	+		
16	Zsadány	»		+	
17	Nagyléta	»		+	
18	Okány	»		+	
19	Mezöpeterd	»		+	
20	Bojt	»		+	
21	Biharnagybajom	»		+	
22	Hosszuhát	»		+	
23	Nagyrábé	»		+	
24	Szalonta	»		+	
25	Sárrétudvari	»		+	
26	Biharkereztes	»		+	
27	Nagykereki	»		+	
27 b	Szerep	»		+	
28	Magyarhomorog	»		+	
29	Komádi	»		+	
30	Berekböszörmény	»		+	
31	Geszt	»		+	
32	Körösszakál	»		+	
33	Püspökladány	»	+		
34	Emöd	Borsod	+		
35	Szentistván	»	+		
36	Gelej	»	+		
37	Mezöcsát	»	+		
38	Mezökövesd	»	+		
39	Igrici	»	+		
40	Tiboldddarócz	»		+	
41	Miskolcz	»		+	Locality : [illegible]
42	Szihalom	»		[illegible]	[illegible]

	Communes	Komitats	Moroccan Crickets	Italian Crickets	Remarks
	Szakáld	Borsod		+	
	Keresztespüspöki	»		+	
	Boldva	»		+	
	Lajosszalonta	»		+	
	Tiszaszöllös	»		+	
	Nagylak	Csanád		+	
	Makó Kunágota	»		+	
	Csanádalberti	»		+	
	Hódmezövásárhely	Csongrád		+	
	Szentes	»		+	
3	Fülöpmajor	Fejér		+	Locality : Pátka
4	Csákvár	»		+	
5	Csókakö	»		+	
6	Tarjánpuszta	Györ		+	Pannonhalma
7	Pér	»		+	
8	Mezöörs	»		+	
9	Bönyrétalap	»		+	
0	Püspöktelep	»		+	
61	Kaba	Hajdu	/	/	Kiskaba
62	Macs	»	/	/	
63	Nádudvar	»	/	/	
64	Hajdusámson	»		/	
65	Hajduböszörmény	»		/	
66	Hajduszoboszló	»		/	
67	Balmazujváros	»		/	
68	Földes	»		/	
69	Nagyiván	Heves	+		rare
70	Tiszafüred	»	+	+	rare
71	Poroszló	»	+		
72	Karácsond	»	+		
73	Aldebrö	»	+	+	
	Feldebrö				
74	Sarud	»	+	+	
75	Ujlörincfalva	»	+		
76	Pély	»	+		
77	Kisköre	»	+	+	
78	Visznek	»	+	+	

No.	Communes	Komitats	Moroccan Crickets	Italian Crickets	Rem[illegible]
79	Boczonád	Heves	+	+	
80	Tiszanána	»	+		
81	Hidvég	»	+		
82	Tarnaszentmiklós	»	+		
83	Mezőtárkány	»		+	
84	Nagytálya	»		+	
85	Recsk	»		+	
86	Abasár	»		+	
	Markaz				
87	Domoszló	»		+	
	Matraszöllös				
88	Gyöngyöspuszta	»		+	
89	Pásztó	»		+	
90	Kisnana	»		+	
91	Tarnaörs	»		+	
92	Erdőtelek	»		+	
93	Kerecsend	»		+	
94	Kompolt	»		+	
95	Tarnamera	»		+	
96	Heves	»		+	
97	Feldebrő	»		+	
98	Erk	»		+	
99	Verpelét	»		+	
100	Adács	»		+	Locality [illegible]
101	Vecs	»		+	
102	Nagyfüged	»		+	
103	Hatvan	»		+	
104	Eger	»		+	
105	Atkár	»		+	
106	Dévaványa	Jász-Nagy-Kun-Szolnok	+		
107	Törökszentmiklós	»	+		
108	Jászapáti	»	+		
109	Jászkiser	»	+		
110	Nagykörü	»	+		
111	Kötelek	»	+	+	
112	Besenyszög	»	+	+	
113	Tiszaroff	»	+	+	
114	Kárcag	»	+	+	and [illegible]
115	Kisujszállás (Csudaballa)	»	+	+	
116	Gyoma	»	+	+	
117	Turkeve	»	+	+	
118	Pusztatenyő	»		+	
119	Tiszaderzs	»		+	
120	Alattyán	»		+	
121	Tiszaszentimre	»		+	
122	Kunmadaras	»		+	

	Communes	Komitats	Moroccan Crickets	Italian Grickets	Remarks
	Fegyvernek	Jász-Nagy-Kun-Szolnok		+	
	Mezötur	»		+	
	Tiszavárkony	»		+	Felsöszászberek Farm. *Platycleis* sp.
	Jászbereny Ujszász	»		+	
	Mesterszállás	»		+	
	Szajol	»		+	
	Szolnok	»		+	
	Kunhegyes	»		+	
	Tiszasas	»		+	
	Jásztelek	»		+	
	Jászdózsa	»		+	
	Czibakháza	»		+	
	Mocsa	Komárom		+	
	Balassagyarmat sziráki járás	Nógrád		+	
	Kálló	»		+	
5	Buják	»		+	
9	Kisterenye	»		+	
0	Zagyvapálfalva	»		+	Kökut Farm.
1	Penz	»		+	
2	Alsópetény	»		+	
3	Salgótarján	»		+	
4	Tahitótfalu	Pest	+		Infrequent.
45	Gomba	»	+		
	Okécske	»		+	
47	Jászkarajenö	»		+	
48	Mende	»		+	
49	Gyömrö	»		+	
50	Ujkécske	»		+	
51	Nagykörös	»		+	Tetetlen Farm.
52	Kiskörös	»		+	
53	Gödöllö	»		+	
54	Pusztavacs	»		+	
155	Büdszentmihály	Szabolcs		+	
156	Tiszadada	»		+	
157	Tiszabüd	»		+	
158	Polgár	»		+	
159	Tiszadob	»		+	
160	Tiszaeszlár	»		+	
161	Tiszalök	»		+	
162	Pap	»		[illegible]	
163	Ujfehértó	»		+	
164	Mikecse	»		+	

No.	Communes	Komitats	Moroccan Crickets	Italian Crickets	
165	Nyírgyulaj	Szabolcs		+	
166	Királytelekpuszta	»		+	
167	Szombathely	Vas			Orphan
168	Enying	Veszprém		+	
169	Hajmáskér	»		+	
170	Hernádnémeti	Zemplén		+	
171	Kesznyéte	»		+	
172	Alsóberecki	»		+	
173	Girincs	»		+	
174	Becsked	»		+	
175	Pácin	»		+	Locality
176	Olaszliszka	»		+	
177	Boldva	Borsod	—	—	Orphania
178	Banréve	Gömör	—	—	»
179	Kéthely	Somogy	—	—	»
180	Nagydobos	Szatmár	—	—	Locusta da
181	Gyalóka	Sopron	—	—	Orphania
182	Felsöszakony	»	—	—	»

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s in the Colony of Eritrea.

eport from the Government of Eritrea, transmitted to the International a of Agriculture by the Italian Colonial Minister.

uring 1924 no flights of locusts took place throughout the Colony trea. Only in the valley of Barca was an excessive multiplication ne local and sedentary species noticed, of which *Tryxalis variabilis* e most numerous and caused slight injury to the durra crops, attack-e still immature cariopses.

nowledge as to the directions from which the invasions come, the of multiplication, dominant species and biology, is limited therefore at it was possible to ascertain up to 1916, the year of the last in-n.

Reports of the invasions which took place from 1902 to 1916 were nitted to the International Institute of Agriculture, which published nograph (1) on the subject.

The experience of past years shows that the Colony is subject to in-ns from the south and south-east, coming from the Sudan, and that oast region from Zula-Sahel to the Sudanese frontier is a zone of er reproduction.

The control of locusts therefore necessitates careful vigilance and pt reporting of flights, the zones of oviposition and the appearance he young larvae.

The Heads of Districts and Territories and those engaged in the various nial Services are required to transmit these reports to the nearest ict politico-administrative authority, who must in turn take prompt sures to advise the Government and all the other District Authorities to organise control measures, employing the natives and with the aid, n necessary, of military detachments.

Owing to the local and demographic conditions of the Colony, the k cannot be carried on except by the destruction of the eggs and the sts in the first stages of their life.

The measures taken and instructions given by the Government at beginning of each agricultural season, and by the District Commis-iers by means of proclamations, are based on these conditions.

custs in Italian Somaliland (2).

Communicated by the Government of Italian Somaliland and transmitted the International Institute of Agriculture by the Italian Colonial Ministry.

The last noteworthy invasion of locusts in Italian Somaliland took ce in 1913.

Others had previously ocurred within a comparatively short period, nely in 1912 and 1905. These invasions, according to the reports, all

(1) International Institute of Agriculture *Control of Locusts in Various Countries*. me 1916.

(2) See also: *R.* 1924, No. 1032. (*Ed. note*)

came from Abyssinia, and this is also confirmed by the fact that the invasion occurred simultaneously, both in south Somaliland, Eritrea.

The damage done in every case was very great. In fact, the ... and cultivated plants on the route taken by the locusts were almost totally destroyed. This route terminated in every case at the ... coast of the Indian Ocean, in the waters of which most of the ... drowned.

Apart from the above instances, no other invasions took place, small or great, which was fortunate for agriculture in the Colony.

Locusts are included among the insects living in a non-migratory ... in the various parts of Somaliland ; they are in such small numbers ever and so dispersed over vast areas that they need not be taken into consideration, and this is true to such an extent that among the ... which annually damage fields and crops, locusts cause the least ...

Grasshoppers on the other hand cause comparatively greater ... than locusts, by biting off and devouring the tender shoots, but ... whole these also exist only in negligible quantities.

The year 1924, like the ten preceding years, closed without ... locust invasion being recorded in the neighbouring countries and ... any reawakening of activity on the part of native locusts in ... Somaliland.

Locusts in Egypt.

Communicated by the Royal Egyptian Legation in Rome, to the International Institute of Agriculture.

No invasion of locusts in any part of Egypt was reported ... year 1924, and circumstances have not called for researches of a ... nical, scientific, legislative or administrative nature, as no species ... injurious locusts exist permanently in the country.

ENQUIRY ON THE OLIVE FLY.

Control of the Olive Fly (*Dacus Oleae*), in Turkey.

Communicated by the Turkish Ministry of Agriculture to the International Institute of Agriculture.

In 1924 measures against the "olive fly" (*Dacus oleae*) were carried out in the following districts of Turkey: Baldjova, Bodja, ... Karessi near Smyrna ; Esine, Lapseki and Bairamidj near the Dardanelles ; and Moudania, Kemlik and Chrhan Gazi near Broussa.

The spraying method was used (arseniate of soda, molasses and water).

The work was begun on the 15th May and continued on days when ... rain fell.

ie results obtained were satisfactory; 80 % of the olives reached size and remained healthy.

ie work will be continued during the year 1925, and more improved ds will be adopted.

ENQUIRY ON TESTING OF DAIRY COWS.

Annual Enquiry.

n pursuance of the resolution passed at the last General Assembly e International Institute of Agriculture, held in May 1924, Enquiry X has been sent out with date 30 March of the current year. The t of this Enquiry is to collect information as regards the development ry cow testing in each year, and the results obtained. The question- has been sent to the 71 countries adherent to the Institute, as well 44 other States and Colonies.

AGRICULTURAL INTELLIGENCE

AGRONOMY.

Soil Science.

See *R.* Part II, *Proceedings of the International Society of Soil Science.* **Abstracts.**

Fertilisers and Manures.

268. **Fertilizers and Fertilizing.**

FORTI CESARE. I concimi e le Concimazioni. *Nuova Enciclopedia Agraria Italiana.* 1 Vol., 8 vo., 362 pp., figs. 131, 3rd ed. Unione Tipografico-Editrice, Torino, 1924.

In the first part of this volume of the "Nuova enciclopedia agraria italiana" the author examines the elements of fertility, taking under consideration the cycle of organic and mineral substances. An examination of inorganic and mineral fertilisers (nitrates, phosphates, potash and lime) is given, describing briefly in each case the method of manufacture, properties and uses, not omitting compound, complex and catalyptic fertilisers.

Part III, deals with organic fertilisers and after treating of green manuring, farmyard manure is discussed, its production, storage, value and use in agriculture; the author then studies fertilisers derived from human excrement, sewage, industrial residues and waste.

Finally, there is the practical application of fertilisers, in which, from the knowledge of the action and quality of fertilisers and the nature of the soil, the formula for fertilising is deduced. The method of application, controlling and trade, form the subject of a further chapter after which follows statistical information, derived in great part from the publication of the International Institute of Agriculture, "*World Production and Consumption of Chemical Fertilisers.*" A. F.

269. **Chemico-Physical Influences of Lime and Calcium Carbonates on Soil.**

RAMANN, E. (Forest Experiment Station, Munich, Germany). *Soil Science*, Vol. XVIII, No. 5, pp. 387-400. Baltimore Md., 1924.

The application of lime causes changes in the soil which are much more complicated than has been realised up to the present, and which depend not only on physical conditions, but also on the chemical composition of the soil itself.

The flocculating influence shows itself when the re-expansion value of the solution has been regained. Compared with the re-expansion value of quartz which is 0.013 gm. per litre, in a soil with 20-30 % of moisture, the quantity of lime necessary for precipitating a litre of soil (s. g. 1.5) is 0.0025 gm.–0.004 gm., which corresponds to an application of 5-10 kg. of CaO per ha. This quantity corresponds to a P_H of 10.5. The flocculating effect, once obtained, continues, provided it is not interfered with by mechanical influences; the crumbling of the soil continues even when the lime has been transformed into carbonate, which, in turn, favours crumbling. A certain quantity of lime, however, should always remain in the soil, to ensure the necessary physical reaction. In view however of the unfavourable influence of the alkaline reaction on the majority of crops, it will be necessary to apply the quicklime very early, so that at the beginning of the growth period the greater part should have already been precipitated as carbonate.

Considerable quantities of calcium hydroxide are combined in the soil by adsorption and the exchange of bases. By adsorption the soil solution loses its bases and loses more or less of its influence on plants. The exchange of bases is rendered easy in acid soils, in which fertilising with quicklime is useful ; this is not the case in silicate soils should they contain exchangeable potassium or sodium. In such cases the lime will replace the potassium and sodium, and these in turn pass into solution as hydroxides, which are notoriously harmful to growth even in low concentrations. In the presence of these the alkalinity of the soil continues much longer, because the alkalies are not precipitated by the carbonic anhydride, as happens in the case of lime.

It is clear therefore that the lime may cause serious harm if it has been preceded by potash fertilisers ; in such cases the harmful factor is not the lime, but the alkaline hydroxides which have formed. The lime therefore should be applied so that the soil can absorb it as well as the alkaline hydroxides formed. Lime fertilising, in order to be scientific, should be preceded by an examination of the soil, of its degree of saturation and exchange of bases.

Another important point, not yet investigated, is the decomposing influence of the quick-lime and hydroxides on the silicates, and the transformation of the lime absorbed.

The well-known influence of quick lime as a fertiliser becomes obvious. It should not however be applied in larger quantities than the soil can adsorb, and it should always be applied in smaller quantities than those

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usually estimated. The simultaneous application of potash salts, and especially of kainit, should be absolutely avoided; it is advisable to apply lime in autumn and potash in spring.

With the application of carbonate of lime, and especially of marls, the influence is durable but slow. The soil silicates, which lose their bases in the exchange, regain their influence, while the soil texture is also improved. The neutralisation of the soil is effected by transforming the carbonate of lime into acid carbonate. The crumbling influence is not very great, because the acid carbonates act as neutral salts, while the concentration of the greater part of the soil solution does not reach the re-expansion value of the salt. On the other hand there are considerable physical and perhaps also chemical influences through the formation of carbonate of lime from the bicarbonate.

The influence of quick-lime, however, cannot be considered as equal to that of carbonate of lime, as the physico-chemical influences of the former are quite different, since it has a great influence on the soil equilibrium. Both, however, are considered to be great improvers of the soil, but are less important from the point of view of nutrition. They should be applied after a careful examination of the soil conditions. A. F.

270. The Effect on Soil Reaction of Long-Continued Applications of Calcium and Magnesium.

BURGESS P. S. *Soil Science*. Vol. XVIII. No. 3, pp. 169-172. Baltimore, M. 1924.

An account of tests made during a period of 15 years, the results of which show that the maximum neutralising effect is obtained with magnesium hydrate, followed by calcium hydrate. Next in order follow finely-ground magnesian and calcium limestone. A. F.

271. Synthetic Calcium Silicate as a Source of Lime for Soils.

BARNETTE, R. M. (New Jersey Agricultural Experiment Station). A Comparison of the Influence of Synthetic Calcium Silicates with other Forms of Lime as Affecting Plant Growth. *Soil Science*, Vol XVIII, No 6, pp. 479-491, tables 6, Bibl. Baltimore Md., 1924.

Synthetic calcium silicate is a product containing 80 % of di-calcium silicate and relatively large percentages of sodium and aluminium compounds as impurities. Another silicate with which the author has made experiments is the so-called "limosil" prepared in a process for the recovery of potash from glauconite: it contains about 13 % free lime in the form of calcium hydrate.

The following are the general conclusions drawn by the author from his experiments: — Both these silicates are as effective as the common forms of lime when applied to so-called acid soils, on an equivalent CaO basis. There is an exceptional increase in the growth of barley on soils treated with di-calcium silicate, and the greater barley yields obtained

are probably due to the greater absorption of the silica, resulting in a healthier and heavier plant.

The results obtained as regards nitrogen percentages in the crop are similar to those accompanying the other preparations of calcium.

A. F.

272. Mauritian Pen Manure.

HARDY Prof. F. *Tropical Agriculture*, Vol. I, No. 8, pp. 116-118. Trinidad, 1924.

The author alludes to the method evolved at Rothamsted for making artificial manure by treating straw with water, ammonium sulphate and ground limestone, and then describes a practice carried out by planters in Mauritius whereby the output of pen manure may be largely increased.

The practice consists in spreading machine-cut cane trash, herbage or bush to a depth of about 2 feet in a covered pen. Cattle are turned into the pen daily for 14 days. The urine soaked litter is then transferred to a pit, with stone or concrete floor and sides, in which the material is stacked, the process being repeated until the pit is full. When the mass has broken down the manure is carted into the fields.

The end product is not only in a form suitable for the land, but contains much greater amounts of nitrogen than were originally present, owing to the work of nitrogen-fixing bacteria.

The Mauritius method enables large quantities of manure to be made with a limited number of animals, and very diverse kinds of cellulose material may be employed. The most serious disadvantage is the initial cost of the trash cutter, pen and pit, and the handling of the material.

The author gives data relative to an experiment made in Trinidad: the pen measured 100 feet by 30 feet, divided into two compartments; alongside the pen was the pit, 100 feet by 20, by 6 feet deep, made of concrete, the whole being covered by a roof.

Twenty cattle were turned into one compartment of the pen for 14 days, after which the second was used, the contents of the first being transferred to the pit. By this plan, 2000 tons of manure per annum can be made by 20 cattle, or 100 tons per head, as compared with 20 tons per head by the ordinary method.

Analysis showed that the manure differs little, if at all, from that prepared in the usual manner. It was found that a storage in the pit of one week is sufficient for the production of a satisfactory manure.

W. S. G.

273. The Availability of Nitrogen in Peat.

LIPMAN C. B. & WANK M. E. (University of California). *Soil Science*, Vol. XVIII, No. 4, pp. 311-316, figs. 2, bibliography. Baltimore, Md., 1924.

From the authors' growth tests, peat, whether treated or not treated with acid and subjected to steam pressure, is not a source of available nitrogen.

A. F.

274. Marine Fertilisers in Galicia (Spain).

ROF y CODINA, Prof. Juan (Inspector de Higiene y Sanidad Pecuaria). *El Cultivador moderno*, Year XIV, No. 8, pp. 12-13, figs. 2. Barcelona, 1924.

In addition to the increasing quantities of chemical fertilisers used by the farmers of Galicia, such as superphosphates, basic slag, potassic salts and other fertilisers, manure is still produced in large quantities, and shell sand, sea-weed, and fish residues are also employed.

Shell sand. — From the sea-beaches opposite the breeding-grounds or banks of molluscs, during the spring and summer, are taken the sand and detritus washed up by the sea, together with quantities of chalk, sometimes above 70 %; this sand also contains 1 % of phosphorus and some potash. Lime and phosphorus being very scarce in Galicia, the utility of this sand for crop cultivation will be readily understood, in addition to the improvement it causes in the texture of soils very rich in humus. Only sands of the finest grain are utilised. Although the carbonate of lime and the phosphorus they contain are in a somewhat insoluble form, the carbonic acid of the air and that secreted by plant roots, in addition to other acids, attack and make soluble these salts, hence the smaller the grains the larger is the surface they present and the more rapidly will they be dissolved.

Sea-weeds. — The sea-weeds *fucus* and *laminarius* are found both at the bottom of the sea, in the mouths of rivers and on the surface of rocks washed by salt water. The high tides in summer detach large quantities of sea-weed, which are washed onto the beach, as is the case with the storms in winter. These sea-weeds form a good fertiliser, as they contain nitrogen, potash, phosphoric acid and lime in varying quantities, in addition to which the cost of collecting and transport is negligible. They are used green after being drained of salt water; some farmers mix them with organic fertilisers, and others dry the weed more carefully after removal of the sodium chloride contained on being first taken from the sea. The weed is used as a substitute for manure by farmers who possess no livestock.

Crustaceans. — At the mouths of rivers in Galicia, there are in some places masses of crabs, especially in summer, in Sada, Betanzos, Puentedeume, Ferrol, Cedeira, Coruña, etc. The crabs are easily gathered and are sold to the farmers, who call them "*pateixo*", which is an excellent fertiliser, rich in phosphorus and lime. If the crabs are dug into the soil immediately after being gathered, their decomposition is slow, hence it is usual to spread them over the soil until patches are shown around the "pateixo", caused by fatty matter, and the "pateixo" is then ploughed in. Crops sown on soil which has been treated with this fertiliser, are easily distinguished from neighbouring crops, by their better development.

Fish residues. — The large quantities of residues from the pickling, preserving and salting factories which abound in Galicia, applied as fertilisers, are buried immediately in the soil. The author mentions the various kinds of residues utilised, and considers that it would be better

to treat them first with steam under pressure, to free them from acids and then, when dry, to reduce the mass to powder, as transport and preservation in this state would be much easier. Part of this fish powder might be used as a cattle-feed. The necessity is shown of establishing similar industries to those found at the French fishing ports, in Galicia at such ports as Vigo and Coruña.

The author draws attention to the importance for Galicia of such industries as could be founded on the abundance of the coast products, which are utilised to-day, but only in their crude state; it is probable that "*pateixo*", reduced to powder, would form a useful cattle-feed when used in conjunction with other fish residues. E. M. F.

275. **The Present Trend of Developments in the Nitrogen Problem.**

BRAHAM, J. M. Abstract from *Industrial and Engineering Chemistry*, Vol. XVI, No. 12, p. 9, figs. 3. Washington D. C., 1924.

The nitrogen problem is of the utmost importance, from the military point of view, in the manufacture of explosives, as also from the agricultural point of view and, consequently, in the question of food supply all over the world.

The atmospherie nitrogen industry which began only about 20 years ago, now produces 500,000 tons of nitrogen annually, equivalent to about 3,300,000 tons of Chili nitrate of soda and almost half the world's production of inorganic nitrogen. In 1922, 75 % of the total output of fixed nitrogen was produced by Germany.

The three chief methods of nitrogen fixation are:

Electric Arc. Produces annually 36,000 tons of nitrogen, of which, 95 % is obtained in Norway. The principal obstacle to production is the enormous quantity of energy required, hence it cannot be adopted except where electric energy is very cheap.

Cyanamide Process. Requires less than a quarter of the energy needed by the foregoing and is therefore more widely adopted. The present production is

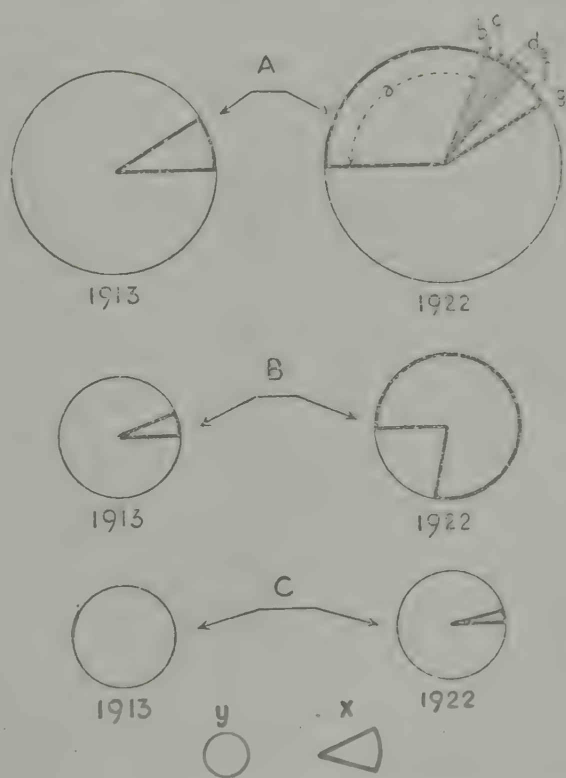

FIG. 91. — Relation between the production of fixed atmospheric nitrogen and the total consumption of inorganic nitrogen.

A. = the world; *a* = Germany; *b* = United States; *c* = Norway; *d* = Japan; *e* = Italy; *f* = France; *g* = other countries. B. = Germany; C. = United States; *x* = production of synthetic nitrogenous manures, *y* = consumption of mineral nitrogenous fertilisers.

140 000 tons annually, about four times that produced in 1913. The chief disadvantage is that calcium cyanamide is by no means a satisfactory fertilising material, while the cost of converting into other substances (sulphate of ammonia and urea) is too high, so that it cannot compete with Chili nitrate.

Direct Synthetic Process. This will probably be most extensively followed. In the various methods employed (HABER-BOSCH in Germany, CLAUDE in France, CASALE in Italy and that of the General Chemical Company in America) the same fundamental reaction is used, but they differ as regards pressure, origin and methods of purification. At present the 14 factories of the world (others are under construction) have an output of 320,000 tons, of which 50 % is produced in Germany.

The quantity of energy required and of nitrogen produced is shown in the following table:

Electric arc	68,000	7.3
Cyanamide	15,000	28.2
Synthetic ammonia:		
Electrolytic hydrogen	20,000	2.0
Hydrogen from water gas	4,000	62.5

As will be seen from the above, the energy required by the cyanamide process is about 22 % of that for the electric arc process and that with the water gas process only 6 %. The present tendency in fixing atmospheric nitrogen is to require less and less electric energy and to change what began as an electro-chemical industry into a chemical industry.

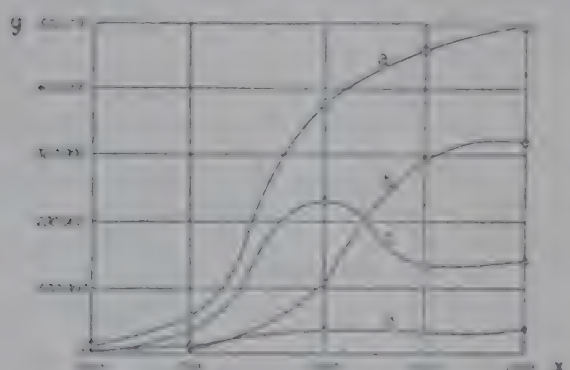

FIG. 92. — Development of the nitrogen fixation industry. (Ordinates show world production of nitrogen, in tons), *x*. = years; *a* = total fixed nitrogen; *b* = fixed nitrogen as ammonia; *c* = fixed nitrogen as cyanamide; *d* = nitrogen fixed by the electric arc.

The products of the synthetic processes also require further modification. Besides sulphate, which is already well known, the following products should be mentioned:—

Phosphate of ammonia. It contains 14.7 % of ammonia and 61.7 % of phosphoric anhydride, is very stable, non-hygroscopic, and has been used with good results. The manufacture depends on the production of phosphoric acid; at a low cost it is probable that this compound will be more used in future.

Nitrate and nitrate-sulphate of ammonia. The first is excellent but too hygroscopic, hence methods of avoiding this disadvantage are being examined, especially those for the manufacturing of a granulated and oiled product. The latter is much used in Germany.

Ammonium chloride. The development of the synthetic process, especially as connected with the manufacture of SOLVAY soda, is opening

up new possibilities for the production of this satisfactory fertiliser at a low cost.

Urea. This is perhaps the most interesting product of the fixation processes. It contains 46.6 % of nitrogen, corresponding to 55.6 % of ammonia, has good physical properties and has given excellent results in practice. The most promising method of production is that of the direct combination of ammonia and carbonic anhydride at a comparatively high temperature and pressure.

Nitrates of calcium and soda. The former gives good results, but has the disadvantage of being hygroscopic and of containing only 13 % of nitrogen. To the production of the second, the principal obstacle is the high cost of soda, the neutralising agent,.

The present tendency, is to obtain fertilisers in which the nitrogen is as concentrated as possible and to combine therewith other fertilising substances, such as potassium and phosphorus. A. F.

276. **A Comparison of Atmospheric-Nitrogen Fertilizers.**

ALLISON, R. V. (Rothamsted Experiment Station). *Soil Science*, Vol. Vol. XVIII, No. 5, pp. 339-352, 1 fig. bibl. Baltimore, Md., 1924.

The atmospheric-nitrogen fertiliser industry has spread greatly especially after the war, in consequence of which a practical comparative investigation as to the efficacy of these fertilisers as compared with the nitrogen fertilisers which have been in use for some time (nitrate of soda and sulphate of ammonia), has become necessary. The author's tests lasted 3 years and were made especially with cotton, maize and tobacco.

Nitrate of ammonia. This gave results quite equal to those of the substances with which it was compared in the tests. It is readily available and has no abnormal effects. The greatest objection to its use is the facility with which it absorbs moisture, rendering it sometimes unusable for fertiliser mixtures. This drawback can be obviated by preparing it in a granulated form and oiling, or converting it into double or mixed salts.

Double salt of nitrate and sulphate of ammonia. This produces the same effect as the single salts ; the fertiliser is less hygroscopic than the nitrate salt of ammonia.

Double salts obtained from nitrate of ammonia with chloride or sulphate of potassium. The above remarks also apply to this fertiliser.

Phosphate and superphosphate of ammonia. These are excellent sources of nitrogen, promote growth and give a satisfactory yield. The large amount of phosphorus partially masks the effect of the nitrogen.

Ammonium chloride. This is readily available, but in some cases when applied in quantities of 40-60 lb. per acre, has had a toxic effect, probably due to an excess of chloride ion.

Urea. Similar in its effects to the other substances and has the advantage of being physically an excellent substance, which, in addition, leaves no basic or acid residues. It seems therefore to be the ideal nitrogen fertiliser.

Uraphos. Gives varying results; it has been used only to a limited extent and no definite conclusions can be drawn.

Cyanamid. Gave less satisfactory results than the other fertilisers, mostly because too many factors, both in the soil and the fertilising mixtures, influence its decomposition. Results are poor when applied together with acid phosphates, this being probably due to the transformation of a part of the cyanamid nitrogen into dicyanamid, a compound which not only cannot be utilised as a source of nitrogen, but which is decidedly toxic to some plants and to nitrifying bacteria.

If applied separately from the phosphates, it gives good results, especially when phosphate of lime or basic slag are used as a source of phosphorus.

Cyanamid gives different results with different crops, being satisfactory for maize, and not so for cotton, probably because the latter requires nitrogen as a nitrate, whereas maize can utilise it also as ammonia. With the winter cereals, especially wheat and rye, results are in all respects similar to those obtained with the check fertilisers. A. F.

277. **Decomposition of Calcium Cyanamide during Storage.**

JACOB K. D., KRASE, H. J. and BRAHAM J. M. (Fixed Nitrogen Research Laboratory, Washington). Industrial and Engineering Chemistry, Vol 18, No. 7, pp. 684-697, figs. 2, bibliography. Washington, D. C., 1924.

Calcium cyanamide when exposed to the air absorbs moisture and carbonic anhydride and it consequently follows that the nitrogen, which is originally present to a great extent as cyanamidic nitrogen, undergoes a partial transformation. The importance of this decomposition depends on storage coditions, such as : temperature, moisture, length of the period of storage, whether in bags or heaps and the hydration of the calcium cyanamide itself.

The authors have studied the nature and extent of the decomposition, under various conditions of preservation, of small and large quantities and for periods of time up to 2 ½ years.

When the calcium cyanamide is exposed, in quantities of a few kg., to unusual conditions of moisture and temperature for long periods the cyanamidic nitrogen becomes totally changed into other forms, especially dicyanamide and urea, to the extent of 70-75 and 20-22 % respectively of the total nitrogen. In this case, 7-8 % of the total nitrogen is lost as ammonia. These are considered as laboratory tests, made in conditions which rarely or perhaps never exist in practice.

The cyanamide which has undergone no treatment decomposes more rapidly than that which has been hydrated or oiled. The calcium cyanamide subjected to such treatments and stored in bags of 45 kg. for a period of 6 months, in normal conditions of temperature and moisture undergoes only slight decomposition. And the latter is negligible when the calcium cyanamide is kept in heaps, with but a small surface exposed to the air, as in silos, and the decomposition is then limited to a depth of 20 cm. from the top. A. F.

278. **Chemical and Biological Studies on Calcium Cyanamid.**

JACOB, K. D., ALLISON, F. E., and BRAHAM, J. M. (Fixed Nitrogen Research Laboratory). *Journal of Agricultural Research*, Vol. XVIII, No. 1, pp. 37-69, figs. 12, bibl. Washington, D. C., 1924.

The nitrogen utilised by plants may come from ammonia or from organic forms; but most plants utilise that of the nitrates, so that it is necessary to find in what form the nitrogen of the soil exists in order to known if it can, or cannot, be utilised. This investigation was undertaken in order to ascertain the progress of the process of the formation from calcium cyanamid of ammonia and the oxidation of the latter in the soil. The formation from calcium cyanamid of urea and ammonia is rapid: after 5-10 days there is no more cyanamid. The urea also is quickly transformed into ammonia, which does not accumulate in the soil. The other substances produced by the decomposition of the cyanamid, probably dicyanodiamid, remain, on the contrary, for a long time in the soil.

The nitrification of the cyanamid is slower than that of the urea and ammonium sulphate, and the more abundant the application, the slower the nitrification. After the initial delay of 2-4 weeks, nitrification proceeds in the usual way. Some of the products of the decomposition of the cyanamid, however, are toxic to the nitrifying bacteria, and, if in considerable quantities, cause accumulation of ammonia.

Hydrated or oiled cyanamid has the same effect as the other; the slight advantage of the oiled over the hydrated is due to the fact that the latter contains dicyanodiamid.

Nitrification reaches its maximum with moisture at 10 %, and is nil at 40 %. The most favourable temperature is 38.5 C. Partial sterilisation of the soil with phenol stops nitrification.

The dicyanodiamid, added slowly, disappears to the extent of one half in 2 months ; the nitrogen which accumulated in the soil as ammonia is not quickly nitrified. With 12.72 mg. of dicyanodiamid per 250 gms. of soil, 36 weeks are necessary for the nitrification of the nitrogen added, whereas with more abundant applications there is no nitrification after 40 weeks.

The nitrification of sulphate of ammonia is prevented when there is 10.5 mg. of dicyanodiamid per 100 gms of soil present; $^1/_{10}$ mg. per 100 gms. of soil is sufficient to greatly retard nitrification. The ammonification of urea, on the other hand, is not affected by the dicyanodiamid, even at a concentration of 315 mg. per 250 gms. of soil.

Sulphate of guanilurea decomposes rather slowly into ammonia, which is then nitrified. The addition of urea delays the process of nitrification.

Salts of guanidina (nitrate and carbonate) reduce nitrification for some weeks, and the more so the more abundant the application. Nitrate of biguanid is practically inert; the slight depressions of nitrification observed are due to errors is the test. A. F.

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279. Some Effects of Sulphur on Crop and Soils.

Adams H. R. (Purdue Agricultural Station) *Soil Science*, Vol. XVIII, No. 2, pp. 111-115. Baltimore, Md., 1924.

Soil acidity and the quantity of soluble matter increases with the quantity of sulphur applied and the length of the incubation periods. There is a certain relation between the P_H values and the quantity of soluble matter present, which fact becomes more evident in crops on sand. The increase of soluble salts is undoubtedly due to a great extent to the biological oxidation of the sulphur.

When a certain hydrogen-ion concentration has been reached, the slightest change of acidity is sufficient to bring about definite effects on the plant. Thus in sand there is a good growth at P_H 4.3, but practically none at P_H 4.1. In the case of fine sand with silt, these results are realised at P_H 3.5 and 3.4 respectively. The difference between the two soils show that the degree of acidity at which a plant grows, is related not only to the plant itself, but varies with the soil.

As regards leaching, it is observed that it practically carries away the sulphates, but not the acidity caused by the oxidation of the sulphur. On the contrary, leaching renders the soils slightly more acid.

There is also a certain relation between the P_H values and the total quantity of lime necessary for neutralising the soil under various conditions.

A. F.

280. Influence of Sulphur Oxidation on Solubility of Soil Minerale.

Stephenson, R. E. and Powers W. L. (Oregon Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 4, pp. 317-321. Baltimore, Md., 1924.

In the semi-arid zone of Oregon, sulphur gives excellent results as a fertiliser, especially if used for legumes, in quantities of 50 lb. per acre per year. The reasons for its influence are not clearly known; it may serve as a direct plant nutrient, or bacterial activity may be stimulated, or the nutriment for the plants may be held in solution.

The authors have found that owing to the oxidation of the sulphur into sulphates, there is an increase of lime and potassium soluble in water, but a decrease of phosphorus soluble in water. These results are obtained both in dry and moist soils.

It should however be borne in mind that even small applications of sulphur cause an increase of acidity, and that consequently the continued use of sulphur in even slightly acid soils may finally become injurious through the acidity, unless the latter is neutralised by the use of lime.

In certain conditions the flocculating effect of the oxidised sulphur may be of considerable value, especially in the case of heavy soils and those in which flocculation is necessary in order to carry off the accumulation of alkali. In this respect sulphur acts in the same way as chalk.

A. F.

281. **Chemical Fertilisers in Austria since the War.**

Gesetz vom 21. April 1918, betreffend die Gewinnung phosphorsäurehaltiger als Düngemittel verwendbarer Stoffe. *Reichsgesetzblatt* No. 161, 3 pages. Vienna, 1918.

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NEUBAUER HANS. Die Nährstoffentnahme der Keimpflanzen, und ihre Anwendung auf die Bestimmung des Nährstoffgehaltes des Bodens. *Zeitschrift für Pflanzenernährung und Düngung*, Part 5. Leipzig, 1923.

One of the main causes of the decline in agricultural production during the war was the impossibility of importing the raw materials for the manufacture of artificial fertilisers.

The importation of such fertilising substances was even more pressing a necessity than in peace time, as in consequence of the reduction of the live stock there was much less stable manure available, and the fertilising value of what was available was less, as no concentrated feeds could be given to the animals and a great part of the straw and hay had to be given up to the military authorities.

The small quantities of chemical fertiliser which were available were State controlled, that is to say requisitioned, handled at and distributed from a Central Office. There was only a very small quantity of basic slag and bonemeal, as raw phosphates for the superphosphates were not available, only potash salts and some sulphate of ammonia. The quantities of this fertilising constituent on hand in the gasworks and coke factories were requisitioned for munitions.

The defeat of the Central Powers and the establishment of the Austrian Republic made conditions even worse. Czechoslovakia kept for itself the small quantities of basic slag which were produced at the time, and the large coke factories were also in that country. Only very small quantities of sulphate of ammonia could be manufactured by the Vienna gas-works on account of the small supplies of coal. In addition, the finances of Austria were so unsound that it was impossible to consider any large importation of artificial fertiliser constituents. In consequence a variety of expedients were adopted. Of these one of the most interesting consisted in the exploitation of the phosphate containing remains of various prehistoric animals, which had inhabited the caves of neighbouring mountain ranges.

In the course of the year there was a marked increase in the utilisation of raw fertiliser materials in Austria, which was partly due to steady work on the part of the agricultural co-operative warehousing societies and partly also to the great effort that was made to increase the productivity of the soil by supplying it with the required constituents. The resulting increase in consumption was naturally not uniform but varied in the case of each raw material.

The facts in regard to the different materials will be examined in the following paragraphs :

The imports of basic slag into the territory of the Austrian Republic were :

1919 two half-years	11 118 quintals
1920 for the year	2 617 »
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Of this last amount 92 643 quintals came from Germany and 82 812 from France. There is no production of basic slag in Austria. In 1920 the supply of this universally employed material was peculiarly scant. In the following years there was a noticeable diminution in the content and solubility of the phosphate, which fell to 14 % and less. It is suggested that other processes of manufacture were at the time in use.

The imports of superphosphates and raw phosphates were :

1920	119 894 quintals
1921	44 927 »
1922	16 260 »
1923	157 401 »

Of the quantity imported in 1923, 83 313 quintals came from Czecho-slovakia, 47 116 from Italy, and 11 400 from Holland.

In 1922 superphosphate was also manufactured by the 'Phospha' Company, a general agricultural trading company, which had established factories in the former munition works at Blumau. Returns from this manufacture were however unsatisfactory on account of the competition of the cheaper foreign production and it was consequently abandoned.

As a consequence the manufacture of *Reformphosphat* was undertaken by the firm of the same name in 1922. The process consists in treating finely ground, mineral phosphate with sulphuric acid, with the result that a part of the lime constituents of the phosphate is converted into gypsum, which when the fertiliser is spread on the fields absorbs water, increases in volume and thereby breaks up the soil-particles, making the soil porous and easier for the roots to penetrate. The phosphate does not however become water soluble.

In consequence, the action of the *Reformphosphat* is much slower and only takes effect on damp soils, remaining ineffective on dry soils. The action on meadowland is, owing to its acidity, not so satisfactory as that of the basic slag which contains quick lime and has a strong alkaline reaction, after which clover nearly always establishes itself where the grass has disappeared. This is not the case when *Reformphosphat* is applied, and consequently it is not in demand, and no extension of the sale of this product is to be looked for.

Raw phosphates are scarcely utilised at all in Austria.

Rhenaniaphosphate which is manufactured from artificially prepared slags was imported in small quantities first in 1924, after a consignment had been tested in 1923 in Vorarlberg. It is generally considered as equivalent to basic slag, although it is superior to it on account of its potash content which though small adds to its value.

Towards the end of the war some natural caves were discovered in which there were found considerable masses of material containing phosphates. These were exploited by miners in the years immediately after the War, and the material brought down by wire rope lines into the valleys and loaded on to the railways. At first the small caves near Peggau in South Styria were worked, afterwards the large Drachenhöle near Mixnitz.

This cave lies about 600 metres above the level of the valley and is

connected with the railway station by a wire rope line 2700 metres long. The cave itself is almost horizontal and is 600 metres long with an entrance 50 metres wide and 18 metres high. It is piled with heaps of remains of different prehistoric animals, especially cave-bears, and deer, which clearly used to find a retreat in the recesses of the cave where they could give birth to their young, pass the winter and die. The remains in part consist of bones which are in a good state of preservation and when made the subject of scientific investigations provide much interesting information in regard to the life and habits of these long extinct animals. No fewer than 15 truckloads of bones were examined and, with the exception of such material as had scientific value, were converted into bonemeal and mixed with the cave excreta to form manure. Among the bones were the pelvic bones of three female animals still containing the skeletons of young cave-bears, which had perished with their mother at the moment of birth.

These remains mingled with earth, presumably resulting from the splitting and crumbling of the rocks throughout the cave, and with excremental remains form a reddish clayey mass which contains about 30 % water and varying quantities of hardly soluble phosphates. Layers with 8 % alternate with layers with 16 % of phosphate and layers of moderately soluble alternate with those of almost insoluble phosphates. Some layers contain very small quantities of nitrogen, but in most cases the nitrogen must have been gradually washed away.

The exploitation was first undertaken by the State and afterwards by a *Höhlendüng Bau- und Betriebs-Gesellschaft*, in which the State had shares. The sale of this fertiliser was arranged by the Department for Chemical Fertilisers of the Bureau of Agriculture. About 800 truck loads were utilised, representing the remains of approximately 40 000 cave-bears.

It may be mentioned, that in the cave some 350 metres from the entrance, there is a spring of water close to which, to judge from finds of ashes, bones and tools, there were early human settlements, ascribed to Palaeolithic times.

By a law of 21 April 1918 (*Reichsgesetzblatt* 161) the State has reserved proprietary rights in all caves, but no further exploitation of other caves was undertaken, as the profits to be obtained could not compete with the valuable and comparatively low-priced artificial fertilisers.

The State however exercises its supreme right over the caves and continues the scientific examination of the remains. In connection with some interesting investigations of the caves, various materials were dug out and removed, and as chemical analysis revealed a certain content in phosphates, the material was spread on the neighbouring pastureland, and formed a topdressing.

The cave manure never achieved any great popularity on account of the small content in soluble phosphate and the high water-content.

The use of bonemeal as manure is not of much importance in Austria. Only a small proportion of the available bones are made into culbed free bonemeal, partly in the form of "Idealphosphates" which are obtained by treatment with sulphuric acid. The imports of bonemeal and bone ash amounted in 1921 to 117 metric quintals, the export to 34 206.

Chilean saltpetre which is much prized especially by beet-growers, began to be imported in 1920, a quite inconsiderable quantity of 8 518 quintals being first imported which gradually increased till in 1923 the import reached 15 767 quimtals. In 1924 consignments of the synthetic product known as 'German saltpetre' came in, this fertiliser having the same characteristics as Chilean saltpetre.

The imports of *sulphate of ammonia* were always small and in 1923 amounted to 10 300 quintals only. In 1924 there was an increase importtation of this fertiliser especially of the German artificial type.

Simultaneously a remarkable exportation of sulphate of ammonia took place, amounting in 923 to 6 718 quintals.

There is also a large output of sulphate of ammonia from the gas-works of Austria. The production in 1923 is estimated as 30 000 quintals. In the early post-war years the production was necessarily less, as only small quantities of coal were available for working.

Leunasaltpetre, which is a mixture of saltpetre and ammoniacal nitrogen was brought to Austria first in 1924, an embargo on the export from Germany having been in force up to the spring of that year. This very valuable artificial manure which contains 9 % saltpetre and 18 % of ammoniacal nitrogen has become very popular already on account of its effect which is both rapid and lasting and it should become the nitrogenous fertiliser of the future.

The still more valuable urates have hitherto been imported into Austria in small quantities only.

Calcium nitrate of which 23 582 quintals were imported in 1923 is not yet in favour and only relatively few farmers realize its proper value. It is the cheapest of the nitrogenous manures and can be satisfactorily used by mixing it with basic slag or potash salts before spreading. There is no home manufacture of calcium nitrate.

The utilisation in Austria of *bloodmeal*, *horn scrapings* etc. is negligible.

Potash salts were imported as early as the second half of 1919 to an amount of 39 078 quintals. There was a gradual increase until in 1921 imports reached 224 157 quintals, but from that year onwards there was a decrease, and in 1923 only 186 739 quintals were imported. This decline is to be attributed to the fact that in the first years after the War many kinds of salts with a low potash percentage were introduced, whereas at the present time a product with an exceptionally high percentage (40 %) of potash salts is being imported.

In 1924 a limited quantity of potash salts was imported into Austria from France.

Only a very small proportion of the 4 035 quintals imported of *wood ash* can be used as potash fertiliser. This import is balanced by an export of 13 278 quintals.

Of calcareous fertilisers only small quantities of *quick lime* and a somewhat larger amount of *refuse lime*, that is sweepings and dust from blast ovens, come on the market. The latter is gritty and is full of lime burnt too hard and is seldom of much use. A modern product is *Calconit* which consists of a mixture of 25 parts of ground quick lime and 75 parts of

ground carbonate of lime, and is very effective, particularly on account of the fineness with which it is ground.

Marl and gypsum are scarcely in use at all.

In some towns the collected excreta mixed with peat or with street sweepings and ashes are used as a fertiliser. Naturally this manure is often of small value, because the admixtures tend to reduce the content and because the lime of the street sweepings volatilises the ammonia of the excreta. By reason of the slight efficacy of certain mixtures this fertiliser is now somewhat discredited.

The co-operative warehousing societies and their federations do important work at the present time in the distribution of chemical fertilisers.

Mention may be made of an attempt by the Austrian Government in 1921, while control was still at least nominally exercised, to bring all grain under State control. In order to induce farmers to hand over the largest possible quantity of grain, if possible in excess of the prescribed contingent (the so-called excess contingent) the distribution of fertilisers on the most favourable terms was proposed, but unfortunately the anticipated success did not follow. Many farmers had no confidence in these fertilisers and the distribution was carried out quite mechanically. Various circumstances arose which somewhat detracted from the value of the policy. To mention one curious feature, the distribution in any district was arranged according to an alphabetical list of the farmers: those whose names began with *A* to *I* received kainite, those beginning with *K* to *N*, basic slag, and all the rest sulphate of ammonia.

The NEUBAUER experiments for determining the soil content in nutritive material assimilable by plants are receiving much attention in Austria. The Experiment Stations are completing these tests, and it is said that the NEUBAUER laboratories are shortly to be re-established.

If it should be found possible to determine with precision and in a short time what amount of nutritive material is available in each soil, the knowledge of the proper and successful application of artificial fertiliser will be extended, resulting in an increase in the use of chemical fertilisers and therefore in the productivity of the land. H. K.

Agricultural Botany, Chemistry and Physiology of Plants.

282. Relations between the Agricultural Value of Meadow Grasses and their Anatomical Structure.

SCHINDLER H. Untersuchungen uber den Zusammenhang zwischen dem landwirtschaftlichen Wert der Wiesengraser und ihrem anatomischen Bau. *Zeitschrift für das landwirtschaftliche Versuchswesen in Deutschösterreich*, 1 vol. 8vo., pp. 76, tables 11. Vienna, 1923.

The author investigated the microscopical structure of meadow grasses in order to find an explanation of their varying agricultural value. It was found that the morphological and anatomical characteristics (size and subdivision of the vascular bundles, structure of the leaf epidermis and also the indentation of the edges) can furnish the clue to the differences in the value of such grasses as cattle feeds.

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On these characteristics he bases a system of classification of grasses whether good or bad, and examines the question as to why the number of "noble" grasses has been reduced, and then studies the estimation of the value of the grasses also from the chemical and biological point of view, in connection with the digestion of cellulose.

It was found that the cell walls of grasses can be digested in the stomach of herbivorous animals when the cell walls are not lignified or cutinised. In judging the value of a meadow grass therefore, it is essential to examine the development of the vascular bundles and the thickening of the cuticle. A. F.

283. **Root Thermotropism.**

TREITEL O. Thermotropismus bei Wurzeln. *Botanisches Archiv,* Vol. VII, Parts 5-6. Königsberg, 1924.

According to WORTMANN, thermotropism is the curving in of roots under the influence of a lowering of temperature when placed in moist sawdust. HOOKER recently showed that at an equal fall of temperature, if the roots are immersed in agar, the deformation does not take place, though in this medium their growth and characteristic reaction continue unaltered. This different behaviour at the same temperature was attributed by HOOKER to the different degree of moisture, who considers that it is a question not of thermotropism but of hydrotropism.

On this point however the question is still undecided.

The author then gives the results of his own experiments, in which he was careful to eliminate as far as possible the influence of moisture. In these conditions it was observed that the mere loss of water by the roots could only be followed by their positive curvature. It cannot be stated with certainty however that the degree of moisture in the immediate vicinity of the roots was uniform. It may well be that in consequence of the transpiration of the roots themselves, the aerial region nearest to the warmest part of their surface had a greater degree of moisture, thus allowing the roots to react. This hypothesis suggested the idea of covering the roots with waterproof substance, such as paraffin, vaseline, olive oil, lanoline, etc. Of these, olive oil proved to be the most suitable.

The roots, covered with a light coating of olive oil, when subjected to a reduction of temperature underwent no deformation, apart from a slight positive curvature.

A similar result was obtained by using collodion instead of olive oil. The author thereupon, concludes that the negative curvature obtained by COLLANDER's and SIERP's tests could not be of a thermotropical nature. It remains doubtful whether the facts observed should be attributed to negative hydrotropism which may be decided by further tests, since up to the present only positive hydrotropical curvature of the roots has been observed.

On continuing to lower the temperature only positive curvatures were observed; these also continue if the roots are covered with a coating of collodion. Since the influence of moisture alone is sufficient to cause in

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the same period of time similar curvatures of the roots to those observed on merely lowering the temperature, it may be concluded that the thermotropical phenomena have, at least partially, some relation with the different degree of moisture.

It may also be that the warmer part of the roots withers, and this also seems confirmed by the fact that during the curving, root growth is stopped. G. B.

284. The Absorption of Carbon by the Roots of Plants.

BREAZEALE, J. F. *Journal of Agric. Research*, Vol. XXVI, No 7, pp. 303-311. Washington, D. C., 1924.

The author has carried out many experiments with wheat seedlings in culture solutions and has found that the presence of nitrates in the solution is followed by the presence of carbonates in the ash of the plant.

The absorption of any element of plant food is probably dependent upon the state of equilibrium of both the plant sap and the nutrient solution; this equilibrium may be acid, alkaline, or neutral, and will probably be different for each plant.

The following conclusions were reached:

The presence of sodium or ammonium nitrate, or calcium, sodium or potassium carbonate in culture solutions for wheat seedlings, is followed by the presence of carbonates in the ash of the plants. When sodium nitrate is present in solution the NO_3 ion seems to be absorbed first, leaving in solution some sodium which combines with the water and with the CO_2, to form sodium carbonate or bicarbonate. This in turn gives up CO_2 to the plant. The plant absorbs CO_3 by means of its roots, probably as an ion, or exhudes CO_2 to maintain equilibrium in its tissues or in the nutrient solution.

Wheat plants do not seem to be able to absorb CO_2 from solution in water without the presence of a soluble base. The absorption of a basic radical seems to depend largely upon the absorption of an acid radical. The term "lime-affinity" as applied to plants, might perhaps more properly be stated as "carbonate-affinity". W. S. G.

285. The Blooming of Wheat Flowers.

LEIGHTY, C. E., and SANDO, W. J. *Journal of Agricultural Research*, Vol. XXVII, No. 5, pp. 231-244. Washington, 1924.

The time and manner of the blooming of wheat flowers is the result of the interaction of internal and external factors. When the flowers have reached the blooming stage, the exact time and rate of their opening is determined by meteorological conditions. The chief object of the present investigations is to procure additional information as to the influence of external factors on the blooming of wheat.

For this purpose, the plants examined were grown in a garden at Washington, and belonged to *Triticum vulgare*. More than 400 flowers in 7 ears on 4 plants which began to bloom at about the same time, were

examined, and additional observations were also made on field grown plants and on plants raised in the green-house of the Arlington Experiment Station, Rossyln, Va.

The authors show by means of a diagram the various flowers of the spikelets of each ear, and note the time of blooming. As soon as each flower opened the empty extruded anthers were removed to facilitate observation and prevent confusion in recording the data. It was considered that a flower had bloomed as soon as a perceptible separation took place between the lemma and the palea.

The blooming process of the flowers. — Under favourable conditions the wheat flower begins to bloom by opening the glumes, at first slowly, then more quickly until the extremities of the palea and lemma are generally separated by a distance of 3-4 mm. After the opening of the glumes, the anthers are pushed up by the filaments, which lengthen, and when quite extruded they assume a pendent position. While these phenomena are taking place the anthers dehisce apically along the line uniting the two cylinders. In a certain number of flowers however it was observed that the anthers were completely extruded and pendent before they commenced to open.

In such flowers it was observed that one, two or three anthers, often situated in the folds of the palea, remained held between the glumes. Other flowers showed anthers partially protuding and imprisoned in the tips of the glumes. The greatest length of filament observed was 10 mm., exclusive of the anther which was 3 mm. long. In one case a filament was observed to attain its full length of 10 mm. in 10 minutes. ASKENASY has measured numerous wheat and rye-flower filaments and states that in most cases the fibres grow from 1 to 1 ½ mm. per minute. Immediately after complete extrusion, the pollen, aided by the inversion of the anthers is completely expelled from the pollen-sacs. About a third of it usually falls inside its own flower, causing a plentiful pollination of the stigma; the remaining pollen is scattered around and may fall on the stigmas of other flowers. Cross pollination is apparently effected in this way, especially if the anthers of the neighbouring flowers have been removed, as shown by LEIGHTY and HUTSCHESON, or have aborted. If conditions are unfavourable for the opening of the glumes, the anthers of the wheat flower shed their pollen and fertilise without extrusion, or they may only protrude outside the tip of the glumes. About 5 % of the flowers (19 in a total of 406) recorded in this investigation, behaved in this way. Each of the ears under examination has one or more such cleistogamous flowers, and the maximum number observed in one flower was six. All these flowers yielded grain. Under certain conditions dependent on environment, wheat flowers may be completely cleistogamous.

Time required. — The process of the blooming of wheat flowers is variable. Some open in less than a minute, others require 3 minutes or more. As regards the time which elapses between the beginning of blooming and that in which the anthers attain the pendent position owing to their complete extrusion, observations have been made of 25 flowers at various times of the day favorable to blooming. The time required

for the anthers to assume the pendulous position varied in these 25 flowers from 1 minute 40 seconds to 5 minutes 25 seconds, with an average of 3 minutes 36 seconds. The time required depends on the position of the ear during the period of protrusion of the anthers, on the resistence offered by the glumes, on the movement of the air, temperature, rain and humidity It was found that the time between the opening and closing of the glumes of a flower varies from 11 to 66 minutes. Frequent difficulties were met with in determining the exact time at which the glumes are completely closed owing to the presence of some anthers or filaments in their midst lodging between the glumes. The average duration is 26.5 minutes.

Time of blooming. — The blooming of flowers was observed at various times during the day and night. By "day" is meant the whole period of 24 hours, by "daylight", the period between the rising and setting of the sun, by "twilight", the combined periods of about 1 ⅓ hours each before the rising and after the setting of the sun; "night" is the remaining portion of the "day", without other designation. Of 406 flowers observed, 350 opened in daylight, 28 in twilight, and 28 during the night, the proportion therefore being as follows: 82.6 % in daylight, 6.9 % in twilight and 6.9 % during the night. From the fact that the greater number of the flowers observed bloomed in daylight, it should not be concluded that light is indispensable to flowering, for wheat flowers placed in a dark room reached full bloom, and in the same manner as flowers under natural conditions. The influence on flowering of the duration of the period of daylight or of the changes in the duration of this period was not determined. Other investigations have shown that many varieties of wheat flower and mature in a shorter time after planting when subjected to a long period of daylight, than those exposed to a shorter period. The authors have also studied the order in which the flowers bloom in the ears and in the separate spikelets, the interval elapsing between the blooming of the 1st and 2nd flowers (which varies from a minimum of 1 hour 16 minutes to a maximum of 15 h. 43 m.) and the number of flowers which bloomed at various times during the 6 days (from the 14th to the 19th May) when the observations were made. The results of this last investigation are summarised in the following table:

Hour in the forenoon	
2.01 to 3	7
3.01 » 4	17
4.01 » 5	7
5.01 » 6	5
6.01 » 7	8
7.01 » 8	15
8.01 » 9	29
9.01 » 10	33
10.01 » 11	31
11.01 » 12	32
Total blooming in the forenoon	184

In the afternoon

12.01 to 1	17
1.01 » 2	21
2.01 » 3	41
3.01 » 4	27
4.01 » 5	30
5.01 » 6	42
6.01 » 7	13
7.01 » 8	4
8.01 » 9	7
9.01 » 10	5
10.01 » 1.55 a. m.	15
Total during the afternoon	222
Add: » » » forenoon	184
Total number of flowers observed	406

The authors then investigate the influence of meteorological conditions on blooming, and by means of a graph show the relations between temperature, rain, light at various hours of the day, and the blooming of the flowers. Three periods of intense flowering were noted: the first on the 14th May between 5 and 6 p. m.; the second on the 15th May between 9 and 10 a. m., 1-2 p. m. and 3-4 p. m.; and the third on the 16th May between 9 and 10 a. m., 1-3 p., m. 5-6 p. m. On the 17th and 18th May there was great irregularity in flowering owing to unfavourable atmospheric conditions (cloudiness, rain, changes in temperature).

The lowest temperature noted during this test was 55° F., and the highest, 78°F.; blooming commenced at a temperature of 56°F.

On 6 ears, 383 flowers were studied, and of these, 307 yielded grain, *i. e.* 80.2 %, but it is interesting to observe the variations of this percentage as related to the position of the various flowers in the ear. Thus the proportion of the flowers setting seed, which occupy the lowest place in the ear was 96.6 %, that of those in the highest position was 21.4 %. The flowers of one ear could not be calculated owing to damage by the birds.

The following additional tests were also made: (1) The flowers of wheat ears completely immersed in water until fully matured apparently bloom in the same manner as those of normal ears, except as regards the filaments of the stamens, which do not lengthen, and the anthers which do not open; the flowers under these circumstances remain open for several days. (2) Some plants were placed in a dark room at a temperature of 60°-70°F. for a week at flowering time. The flowers reached full bloom under these conditions in about the same space of time as do those under normal conditions. The flowers blooming in the dark had their glumes as widely separated as those blooming in the light. (3) In a greenhouse at a temperature of 55°-56° F. flowers with their glumes separated by a distance of 3 mm. were observed; the movement of the anthers was easily discernible at this temperature. When the temper-

ature was gradually lowered the lengthening of the fibres was retarded, and at a temperature below 55°F no further movement was perceptible and the anthers apparently remained stationary, but the pollen was discharged at a temperature as low as 52°F.

The maximum temperature at which the flowers were observed to bloom in the greenhouse was 80°F. F. C.

286. On the Cessation of the Assimilation of Potash by Rye Seedlings growing in a disproportionately Small Volume of Soil.

ESCHENHAGEN, M. Ueber den Verlauf der Kaliaufnahme junger Roggenpflanzen, die in einem unverhältnismässig kleinen Bodenvolumen gewachsen sind. *Botanisches Archiv*, Vol. VII, parts 5-6. Königsberg, 1924.

The author investigates the progress of the assimilation of nutritive substances by seedlings cultivated in abnormal conditions, and compares the yields obtained.

The author's investigations include 5 series of tests made under various growth conditions.

The results may be summarised as follows: the yield of dry matter, considered as a function of the increasing potash fertilisation, follows the law of the influence of growth factors; in accordance with the said law, the influence of potash is constant. The assimilation of potash however, like the potash content of the soil, is determined not only by this last factor, but also by the sum of the influence of the other growth factors.

As to the influence of these last it was found that light is only of subordinate importance, while a mean temperature of 11.3°C. has a favourable influence. An important condition for the maximum assimilation of potash was found to be the uniform concentration of the solution. If a nutritive substance in an easily soluble form is placed at the disposal of the plant, it is found to be quickly assimilated by the plant, independently of its growth. The chemical factors of growth are of no importance except when their presence has a direct influence on the assimilation of potash.

In conclusion it must be admitted that the assimilation process of rye plants is not a function depending on the quantity of potash placed at their disposal, but is mainly dependent on the degree of concentration of the solution used. It may therefore be doubted whether the value of a soil can be estimated solely by estimating the quantity of nutritive substances it contains.

From a practical point of view, the method of investigation based on the influence of external factors on plant growth, is perhaps the only one which may lead to the establishment of a practical system of fertilising in order to obtain the maximum yield of a crop. G. B.

287. The Influence of Sodium Chloride on the Growth of Alfalfa.

LOMANITZ S. (New Jersey Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 5, pp. 353-368, 1 fig. 1 plate, bibl. Baltimore, Md., 1924.

Report of experiments in growing alfalfa in water cultures containing sodium chloride, in varying quantities of from 0.0 to 0.6 [illegible]

mospheric pressure; SHIVE solution (at 1.75 osmotic atmospheric pressure) was used as a control. The tests lasted 77 days.

An increase in yield was obtained in 5 out of the 6 cultures, this increase mostly applying to the aerial parts. The absorption curve of the water followed that of the yield. The proportion of root growth to that of aerial part is greater when the total yield is less, and vice versa.

The variations of the nitrogen percentage in the whole plant are not such as to indicate definitely that there is any relation between this factor and the others. The roots of the sulphur chloride cultures contained a larger percentage of nitrogen than those of the control.

The absorption of sodium chloride by the plants varies in direct proportion to the quantity available. The roots however contain less than the aerial part. A. F.

288. **Influence of Moisture and Insolation on the Lupin (*Lupinus augustifolius* L.) and on the Alkaloids in its Seeds.**

MALAVSKI, H. and SYPNIEWSKI, J. Wplyw wilgotnosci gleby i naswiethlenia na rozwoj lubinu (*Lupinus augustifolius* L.) i na zwastosc alkaloidow w jego nasienu. *Pamietnik Panstwowego Institutu Naukowego Gospodorstwa Wiejskiego w Pulawach* (Memoirs of the Polish National Institute of Rural Economy at Pulawy), Vol. 4, Part A, pp. 302-327, resumé in French. Cracow, 1923 (received January, 1925).

In taking up this investigation, the authors proposed to find a means of diminishing the bitter alkaloid content of lupins. The influence of nitrogen fertilisers being of no practical importance, in view of the capacity of the lupin to assimilate the free nitrogen in the air, the authors studied only the influence of physical agents, such as solar radiation and moisture. A pure growth of *Lupinus augustifolius* L. was cultivated in pots in ordinary soil, without any fertiliser, and a group of pots was exposed to diffused light in a roofless tent covered in on the east, west and south; the water given and that evaporated was measured. The control pots were untreated in the open and some had no plants. The moisture was kept constant in each group of pots and varied in quantity from 60 to 20 % of the power of absorption of the soil.

The following results were obtained from these tests:

(1) The lupins cultivated in diffused light flowered and matured first;

(2) the last to do so were those with moisture maintained at 20 %;

(3) evaporation increased up to a maximum which coincided with flowering, and then decreased;

(4) the moister the soil, the more water is lost by evaporation;

(5) the height of the plant, the thickness of its stems and the number and length of the pods increase with soil moisture;

(6) the plants reared in diffused light are smaller;

(7) the weight of the plant, the number and weight of the pods, the weight of 100 seeds, of the stem and of all parts above the ground increases with the moisture;

(8) the plants raised in the shade weigh less in all their parts;

(9) *soil moisture and insolation influence the alkaloid content of the seeds.*

In comparison with the parent seeds used for this experiment, those which were produced from them contained:

(*a*) with a 20 % degree of moisture: 50 % more alkaloids than the parent seeds;

(*b*) with a 35 to 50 % degree of moisture: the alkaloid content was less than that of the parent seeds;

(*c*) with a hygrometric degree of 65 % the quantity was the same as for group (*a*).

As regards insolation, the seeds of a plant reared in the shade contained more alkaloids (nearly double) than those of a plant cultivated in the same conditions as regards moisture under normal insolation. The dry matter of the parent seeds contained an average of 0.68 % of alkaloids, the seeds produced under normal insolation 0.35 %, and those cultivated in the shade 0.82 %.

The seeds of plants reared in diffused light contained 2.5 times more alkaloids than those reared under normal insolation.

As regards the influence of moisture it may be concluded that the divergences, increase or decrease, from the most favourable conditions of soil moisture may determine an increase in the alkaloid content of the seeds.

The results obtained by the authors as regards the influence of insolation are therefore contrary to those obtained by A. GORIS and H. DELUARD in the case of belladonna, according to whom the leaves of these plants contain more alkaloids when reared in the sun than when grown in the shade. In this case however the author considers that the contradiction is only apparent. The alkaloids, like other nitrogenous chemical compounds, form in the leaf, and afterwards, passing into the seed, participate in the synthesis of the albumen. The function of the alkaloids in this synthesis, is not fully understood but the authors are of opinion that if this synthesis takes place in the conditions most favourable to the growth of the plant, the quantity of alkaloids of this transitory or accessory product should be less. All divergencies from the most favourable conditions, either towards a decrease or increase of moisture or insolation, may produce a difference in the alkaloid content of the seeds.

G. Z.

289. **Effects of Moist and Dry Air on the Rate of Respiration and Breakdown of Ripe Pears.**

LUTHRA CHAND, J. (Punjab Agricultural Service, India) *The New Phytologist*, Vol. XXIII, No. 3, pp. 131-142, plates 6. London, 1924.

The investigation of the causes of the spoiling of fruit is of the utmost importance in the finding of satisfactory methods of preservation, especially for pears, which are liable to spoil quickly. Bearing in mind the close relations between respiration, transpiration and physiological

changes, the importance of the moisture or dryness of the air will be readily understood.

The author has observed that in dry air the rate of respiration and transpiration is increased. The great loss in weight is accompanied by shrivelling, and early spoiling. In moist air, on the other hand, the pears retain their healthy yellowish-green colour and keep much better.

The intensity of respiration is lowered as soon as the pear begins to show signs of break own.

The specific weight of the juice is always greater in the external than in the internal parts, both as regards pears kept in moist, and those kept in dry air. On the spoiling of the pear, the specific weight of the juice throughout increases.

Hexose sugars were found in the juice. A comparison between the depression of the freezing point observed and that corresponding based on the quantity of hexose sugar, shows a constant difference, which indicates that acids and salts are also present in the juice.

A. F.

290. **On Starches as a Food Reserve.**

ZIEGENSPECK, H. Ueber Sparstärke. *Botanisches Archiv*, Vol. VII, Parts 3. 4, pp. 251-273, Königsberg, 1924.

The author's investigations tend to show that the substances known under the collective name of starches, from the point of view of plant physiology should be divided into nutritive starches and starches having the character of a food reserve. G. B.

291. **Isolation of a Protein from the Leaves of the Alfalfa Plant.**

CHIBNALL, A. C. & NOLAN, L. S. (Connecticut Agric. Exper. Station, New Haven). *The Journal of Biological Chemistry*, Vol. LXII, No. 1, pp. 173-178. Baltimore Md., 1924.

The authors have isolated from the leaves of the alfalfa plant (*Medicago sativa*) a protein having physical and chemical properties analogous to those of that extracted from the leaves of spinach, especially as regards its sensitiveness to the presence of salts when it is in weak acid solutions.

The said protein of the cytoplasm contains 15.73 % nitrogen and 0.2 % ash. The portion isolated constituted 3.23 % of the solid matter of the leaves.

Of the nitrogen contained therein, 7.49 % is in the form of argenin, 1.79 % histidin and 8.17 % lysin. A. F.

292. **Spinacin, a New Protein from Spinach Leaves.**

CHIBNALL, A. C. (Connecticut Agric. Exper. Station, New Haven). *The Journal of Biological Chemistry*, Vol. LXI, No. 2, pp. 303-308. Baltimore, Md., 1924.

The author has isolated from the cytoplasm of spinach leaves, a protein compound in a state of purity such that it show no reaction by

the MOLISCH carbohydrate test. Taking into account the complex nature of the protoplasm and the little that is known as to its chemical composition, the preparation of this product, which apparently, has undergone no hydrolytic modifications, is of considerable importance. It seems that the protein is present in the cytoplasm as an anion, at a hydrogen-ion concentration only a little below the isoelectric point. It is insoluble in water, but soluble in the slightest excess of acid or alkali, and contains 16.25 % of nitrogen.

The quantity of protein isolated is only $^1/_{10}$ of the total quantity which is said to exist in the cytoplasm.

The author has been able to extract it in quantities of 4.87 % of the total solid matter of the leaves. The protein compound contains 6.65 % of arginin, 2.34 % of histidin and 8.19 % of lysin. A. F.

293. The Chemistry of Grape Pigments.

ANDERSON, R. J. & NABENHAUER, F. P. (Biochemical Laboratory, New York Agricultural Experiment Station, Geneva). I. A Contribution to the Chemistry of Grape Pigments. II. Concerning the Anthocians in Clinton Grapes. *The Journal of Biological Chemistry*, Vol. XLI, No. 1, pp. 97-107. Baltimore, Md., 1924.

One of the authors (ANDERSON) had previously shown that the pigments in two varieties, of American vines (*Vitis aestivalis* and *V. labrusca*) are chemically identical with the Monoglucoside *enine*, already isolated from the *Vitis vinifera*. The pigments of the Clinton grape were now examined. This is the first cultivated variety of the *Vitis riparia*, which seems to contain a substance sim lar to that found in *V. labrusca*.

The pigment of the variety examined consists mostly of a monoglucoside, antocyanine. The antocyanine chloride, $C_{23}H_{25}O_{12}Cl$, does not separate into definite crystalline forms, but the picrate, having the formula $C_{23}H_{24}\,C_6H_2(NO_2)_3(OH)$, crystallises into bright red needle prisms. The glucoside is easily hydrolysed by boiling with dilute hydrochloric acid and gives a molecule of glucose and antocyanidine chloride, $C_{17}H_{15}O_7Cl$, which crystallises in prisms from the warm solution.

The antocyanidine chloride consists mostly of a delphinidine monomethylic ether, also of a certain quantity of dimethylic ether.

The absorption spectra of the antocyanine and antocyanidine chlorides form a wide band which passes from yellow to blue. A. F.

294. The Isolation of the Antiscorbutic Factor

SILVA S. S. (Biochemical Department, Lister Institute, London). The Antiscorbutic Fraction of Lemon Juice. *The Biochemical Journal*, Vol. XVIII, Nos. 3-4, pp. 632-637. Cambridge, 1924.

Id. and CONNELL, S. B. The Reducing Properties of Antiscorbutic Preparations. Do., pp. 638-640.

Id. Id. The Differential Dialysis of the Antiscorbutic Factor. *Ibidem*, pp. 641-646, 1 fig.

SILVA has isolated in lemon juice a fraction corresponding from 0.3 to 0.7 % of the solids, which contains approximately all the active anti-

scorbutic element. It has an extremely low nitrogen and phosphorus content and has a reducing reaction in so far as it reduces nitrate of silver and decolorizes permanganate of potash ; these two reactions are the work of two different fractions.

By dialysis experiments, it is shown that the diffusion of the anti-scorbutic factor proceeds in a different manner from that of sugar and of nitrogenous substances contained in decitrated lime juice. The same property of diffusion is possessed by the juice of the Swede turnip.

The antiscorbutic factor is diffused through colloid membranes of lower permeability than those which allow the passage of methylene blue, neutral red and safranin. The size of the molecules of the antiscorbutic factor is probably not very different from that of the hexose sugar.

F. A.

Plant Breeding and Seeds.

295. **Heteromorphism and the Law of Triple Convergence.**

TIKEL, R. L'étéromorphisme et la loi de triple convergence. *Bulletin de la Société botanique de France*, Vol. 61, No. 5, pp. 510-523. Paris, 1924.

It is a well known fact that there are many kinds of plants in which the forms of the leaves show remarkable variations in the same individuals. GOLBEL has given the name of heteroblasts to these species which are generally known as heteromorphs. NANDIN speaks of bi-form species and DIELS of heteromorphism, to describe in general terms the varying forms which appear at a given period (according to age) determined by the growth stage, and makes a distinction between young and transitory forms (*Folgenformen*). The author considers the question of heteromorphism, both in seeds and roots and arrives at the conclusion that there exists a law which he calls the law of triple convergemce, whereby in heteromorphous woody plants, the leaf of the seedling, the leaf of the auxiblasts (DODE) and the leaf of the rizoblasts converge to form a uniform type. G. B.

296. **The Genetic Relation between *Triticum dicoccum dicoccoides* and Similar Morphological Types.**

LOVE, H. H. (Cornell University Agricultural Experiment Station) and CRAIG T. W. (Office of Cereal Investigation, Department of Agriculture). *Journal of Agricultural Research*, Vol. XXVIII, No. 6, pp. 515-519, 8 plates. Washington, 1924.

The authors state that it is possible to produce *Triticum dicoccum dicoccoides* as a cross between Early Red Chief, a variety of *Triticum vulgare*, and the variety Marouani of *Triticum durum* Desf.

In this paper it is shown, by analysis of the generations, that different varieties, such as occur in nature, may be produced by experimental breeding with the synthetic form.

G. B.

297. On Hybrids from Wheat and *Aegilops*.

LEWICKI, S. and DUTKIEWICZOWNA, B. O mieszancach pszenicy z *Aegilops*. *Pamietnik Panstwowego Instytutu Naukowego Gospodarstwa Wiejskiego w Pulawach* (Memoirs of the Polish National Institute of Rural Economy at Pulawy). Vol. 4, Part A. Cracow, 1923 (Received January, 1925).

Aegilops is not included in the usual genealogy of wheat. Basing on the ordinary indices of relationship, however, and the morphological structure and crossing capacity of the hybrids, there is a species of wheat, *Triticum monococcum*, which shows more differences from the other species of the same kind than exist between it and *Aegilops*. The *monococcum* indeed is distinguished from the other species by its morphology, the quantity of its chromosomes, resistence to certain diseases and serological reaction, and only produces hybrids with other species of *Triticum* with great difficulty.

The question then arose whether there was not a certain affinity between *Triticum monococcum* and *Aegilops ovata*. The authors fertilised the latter with mature pollen of *T. monococcum* and obtained 5 normally developed hybrid seeds, which produced 5 plants. These plants developed ears after 77 days and flowered after 85 days. Flowering continued for a long period and followed a pathological course, as the glumes were open for some days in certain spikelets and the stamens contained very little pollen, and that but slightly developed, and which did not fertilise a single flower on more than 30 ears. Furthermore, the plants had all the characters of *Aegilops* and did not resemble any species of wheat. The result of observations seem to indicate that *Aegilops ovata*, as a generically anterior form, may have taken part in the development of forms of the *Triticum* genus, without it being however possible to assign a place to it in their genealogy.

Basing on these data, the authors consider that: (1) There are no genetic grounds for incorporating the *ovata* species in a distinct genus of *Aegilops*; (2) neither are there any grounds for denying the relationship of the *ovata* form with wheat.

G. Z.

298. Inheritance of Pubescence of the Nodes in the Crosses of two Varieties of Wheat.

LOVE, H. H. (Cornell University Agricultural Experiment Station. CRAIG W. T. (Office of Cereal Investigations, Department of Agriculture) *Journal of Agricultural Research* Vol. XXVIIII, No 8, pp 841-844. Washington, 1924.

Nearly all varieties of wheat have glabrous nodes but there are some which have pubescent (velvet) nodes. The authors make a study of the behaviour of this factor in a variety with pubescent nodes crossing it with others with glabrous nodes and noting the behaviour of the dominant factors in respect to the pubescence of the glumes. G. B.

299. Number of Chromosomes in Maize.

LONGLEY, A. E. (Office of Biophysical Investigations, Department of Agriculture). *Journal of Agricultural Research*, Vol. XXVIII, No. 7, pp. 673-681, plates 3, bibliography Washington, 1924.

One of the lines of enquiry of modern genetics consists in the investigation of the number of chromosomes in the hybrids. The author applies this method to the study of the chromosomes in maize and in different genera of the tribe Tripsaceae.

According to KUWADA, maize (Zea) is a tetraploid species derived from an ancestral type having six as the basic chromosome number. The author however concludes that ten is the basic chromosome number for *Zea mays* and its relatives.

The author accepts in general the conclusions drawn from the recent cytological studies in Rosa, Rubus, Oenothera, Datura, Triticum, Avena and Hyacinthus, made by modern investigators, which seem to indicate that in the polymorphic genera the more primitive and more stable species have a smaller chromosome number than more recent or hybrid forms. G. B.

300. Germination Capacity of the Pollen of certain kinds of Apples and Pears.

KOBEL, F. (Schweiz, Versuchssanstalt in Wadenswil). Die Keimfähigkeit des Pollens einiger wichtiger Apfel- und Birnsorten und die Frage der gegenseitigen Befruchtungsfähigkeit dieser Sorten. *Landwirtschaftliches Jahrbuch der Schweiz*. Year 38, part 4, pp. 461-473, bibl. Berne, 1924.

The author states that the question of the reciprocal fertilisation of certain varieties of apples and pears is being studied in connection with the germination capacity of the pollen, which varies from one kind to another. It is however not enough to count the number of the pollen grains which arrive at maturity, but also necessary to take into account the length and shape of the pollen tube. Fruit-growers should accordingly note these conditions so as to ensure adequate fertilisation in their orchards. G. B.

301. Effect of High Temperatures on Germination and Growth of Maize.

KEINHOLZ, R. (Professor of Botany, University of the Philippines), *Philippines Journal of Science*, Vol. 25, No. 3, pp. 311-346, tables 21, figs. 4, bibliography, Manila, 1924.

There has been a considerable increase in the use of heat in the disinfection of cereals within recent years, and experiments are seldom made to ascertain the effect of treatment on germination. Maize is much more sensitive to heat than wheat and barley.

The author's investigations enabled the following conclusions to be drawn:

Air-dry maize, containing 10-11 % moisture is killed by exposure to 80° and 90° C. for 25 and 10 minutes respectively, and is injured by exposure to 70°, 80°, and 90° C. for 80, 10 and 5 minutes.

The resistance to high temperatures varies inversely as the water content.

Under air-dry conditions diseased maize contains most moisture and disease-free least moisture.

Desiccation brings about changes which cause diseased maize to become very resistant to heat. The nature of these changes is unknown.

The resistance to heat of air-dry maize differs with the variations in climatic conditions.

The amount of growth of seedlings follows, in general, the percentage of germination of the treated and untreated maize. The percentage of germination, green weight and height of plants of heated maize grown in soil, parallel the behaviour shown in germination tests. In air-dry maize, disease-free seed is always highest and diseased lowest. In desiccated seed, diseased is highest and disease-free usually lowest. W. S. G.

302. **The Disinfection of Cotton Seed with Carbon Disulphide.**

FERREIRA, E. *Gaceta Algodonera*, Year I, No. 9, pp. 21-25. Buenos Aires, 1924.

The author after describing the properties of carbon disulphide, says that it possesses excellent antiseptic and antifermentative powers, and has toxic qualities against animal parasites, hence, apart from the care necessary in the use of carbon disulphide, it is the most suitable chemical substance to employ against insects which attack grain and seeds.

The disulphide should be used on dry seeds.

With regard to dosage, the Royal Decree of 2nd June suggests 400 gm. per m^3 for a period of 24 hours. George SMITH advises only 138 gm. per m^3, the period however not extending beyond 24 h. Particulars of the treatment appear in "Distintos metodos para la destrucción de los insectos" (Various methods for the destruction of insects), a leaflet published by the Ministry of Agriculture in 1914. Against "albreca" (*Gasterocercodes gossypii*) in vetch seed, BRUNNER recommends 500 gm. of disulphide under the same conditions, without any *danger of its affecting germination*. Professor HABERLANDT employs a dose of 1 kg. per m^3 to disinfect cereals attacked by Calandra and Tinea. VERMOREL for the same treatment of wheat advises a dose of 1 kg. per m^3. The author gives a long list of various doses used by other authors, in North America the dose is usually 260 gm. per m^3 for 40 hours; if however the operation lasts only 24 hours, the quantity is increased to 434 gm. The author has used 400 gm. for 24 hours, obtaining results which enable the following conclusions to be drawn: the carbon disulphide treatment does not in the least injure the germinative capacity of the seed; it exercises an antifermentative action on weak seed. Disinfection should be carried out shortly before the sowing of the seed (this being done in August, the mean

temperature of which favours the expansion of the carbon sulphide gases); the seed to be disinfected should be quite dry and mature.

The author found a germinative capacity of 68-77 % after separating the weak seeds. A cleaned sample from the last crop was analysed and the germination test gave 48 % of green seed which did not ripen, hence, it was assumed that the sample was a very inferior quality of seed. In order to avoid such seed some characteristics are given which growers might bear in mind, so as to make it unnecessary to carry out the germination test. The following should be rejected: the smallest seeds, with the husk or episperm depressed or dented, sometimes of a yellowish-white colour, yielding to pressure or detaching itself more or less easily when pressed by the nail, and seeds in a more or less developed state. For this purpose three small heaps of 100 seeds each are formed. In each of these heaps, the hard seeds, resisting pressure, are separated from the small, atrophied, weak and useless seeds. Separate additions are made of the respective quantities and the average of good and bad seed is thus obtained. From these data the quantity of seed which should be sown per hectare is then calculated, the germinative capacity being also taken into account. E. M. F.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES.

Cereals, Roots and Forage Crops.

303. **The Tolerance of Wheat for Soil Alkalis.**

NEIDIG, R. E. and MAGNUSON, H. P. *Soil Science*, Vol. XVIII, No. 6, p. 449-67, diagrams 3, tables 8. Baltimore, 1924.

The authors base their observations on the recoverable rather than the added salts. As regards carbonate of soda, it is shown that wheat is not affected by sodium carbonate until 0.1 per cent. recoverable was found. At 0.2 per cent. concentration there was evident toxicity; 0.5 per cent. recoverable salt always resulted in a total crop failure.

Sodium chloride when present alone in the soil is not harmful until 0.2 per cent. recoverable salt concentration is reached; 0.25 per cent. recoverable sodium chloride showed a decided toxicity.

With sulphate of soda their was no detrimental effect until a concentration of 0.75 per cent. was reached.

These results are found with the first crop. In the second crop there is on the other hand a stimulating effect, except in the case of treatment witl the highest quantity of carbonates. A. F.

[303]

304. Superior Varieties of Maize Cultivated in S. Paulo.

LOBBE, H. (Campo de Sementes de S. Paulo) Das melhores variedades de milho cultivadas en S. Paulo. *Revista da Sociedade rural brasileira*, Year V, No. 52, pp. 309-322, 8 plates. S. Paulo, 1924.

In the opinion of the author, maize will be the crop of most value in America on account of its high yield, the ease with which it is cultivated, and its adaptability to different climatic conditions.

As regards the varieties to be chosen for cultivation, he remarks that the two varieties of North-American origin, "Golden Dent" and "Hickory King" appear to be the result of a good selection, the cobs being of excellent quality and all plants up to standard, but on the other hand they are very liable to mildew and in addition require particular kinds of seasons for really successful cultivation.

The *quarentão* of Argentine origin is an excellent variety ripening early, giving two crops in the year and also is popular with the settlers.

The varieties best adapted to the country and most to be recommended are Catteto, Crystal and Assis Brazil, their distinguishing characteristics being richness in protein, starch and oil. These varieties have been definitely adopted for cultivation on a large scale and are distributed from the Experiment Station of São Simão. A. F.

305. The Importance of Maize Cultivation in Guatemala.

JACKSON C. *Revista Económica*, Year XL, No. 7, pp. 370-371. San Salvador, 1924.

Maize is the oldest and the chief crop in Guatemala, and is the almost exclusive food of four-fifths of the population. The yield, according to official returns, is 3 million metric quintals. The author however considers this much below the actual figure, attributing the error to false harvest declarations, and he therefore forms an estimate based on the consumption by the population, by livestock and in industries. Estimating the consumption by the inhabitants at 7,300,000 quintals, that by livestock and for other purposes at 1,700,000 quintals, making a total of 9 millions as the approximate annual production, the value of the annual yield, in Guatemala, at an average price of 2 dollars per quintal would be 18 million dollars.

The author then compares the maize yield with that of coffee (at present the most important export) which is estimated at 10 million dollars; with the sugar-cane, which hardly reaches 5 millions, and with the plane-tree and livestock production; and concludes that though all these productions are very important, none is so important as maize for Guatemala, it being also borne in mind that maize is a national source of wealth, while the others are in foreign hands. He considers that all the industries which utilise maize as raw material should be encouraged, in addition to the export trade.

E. M. F.

306. **Investigation on the Vistula Horse-Bean.**

KARNOWSKI L. Studia nad bobikiem (*Vicia Faba* L., *V. minor* Al.) Cz I Bobik nadwislandski, *Pamietnik Panstwowego Instytutu Naukowego Gospodarstwa Wiejskieog w Pulawach* (Memoirs of the Polish National Institute of Rural Economy at Pulawy), Vol. 4, Part A. Cracow, 1923 (recived January, 1925).

The following is a resumé of the results of three years' investigations by the author on a variety of horse-bean common in the Vistula region.

The so-called Vistula horse-bean belongs to the *Vicia Faba* L. var. *minor subras. equina Al.* variety ; some of its sub-varieties resemble the *columbina Keke.*

The seeds are greyish-fawn in colour. Crossings with the variety having violet seeds and with those having green seeds, yielded in the F_2 generation 25 % of fawn coloured seed, 50 % of pale violet or. in the second case, of slightly marked greenish seed, and 25 % of dark violet in the first case, with as many green seeds in the second. The author concludes that the violet or green colour depends on one factor only.

The hilum is black, grey or light grey, there being 25 to 50 % of plants with a black hilum. In the crossings, 25 % of plants with a black homozygous hilum were obtained.

The form of the seeds may be : (1) a more or less oval spheroid, (2) oblong with blunt ends, (3) oval and flattened at the sides. To distinguish the form of the seeds the following form-index has been adopted : $(L_1 + L_2) : L_3$, where L_1 is the length, L_2 the breadth and L_3 the thickness of the seeds ; this index is preferable to the correlation of the three dimensions coefficient.

The weight of 100 seeds is 15 % higher in moist years than in dry seasons ; the average weight is 55.70 gms. ; variability fluctuates from 14 to 34 %. The length of the stem is 98 cm., with an 11 % coefficient of variability. Length of stem up to the first pod is an important character in selection ; there is a negative correlation between this character and the number of pods ; the corresponding coefficient varies from −1.200 to −0.900. The tendency to form lateral stems only appears if the plant finds all the conditions sufficient for the development of the main stem, or under abnormal conditions ; lateral stems rarely produce mature seeds, but are not unfavourable either to the total weight of the yield or to that of 100 seeds.

The number of pods varies from a minimum of 27 to a maximum of 47 % and is in correlation with the length of the stems and their number.

It has been found that 10 % of the flowers undergo extraneous pollination. Crossing with *Faba major* are easily effected. In the F_1 generation intermediary types were obtained, in F_2, side by side with the paternal types, a whole series of intermediary forms appeared, which proves that these varieties differ from one another in a large number of characters, the study of which has not yet been completed.

G. Z.

[306]

307. Experiments in Acclimatising Scotch Potatoes in Austria.

HAUNALTER Emil, Member of the Council of the Federal Institute for Plant Cultivation and Seed Testing in Vienna. *Oesterreichische Zeitschrift für Kartoffelbau*, Part 1, p. 30, 31 March, 1924. (Appendix p. 31)

In 1921 Austria was almost entirely without seed potatoes, and a delivery of 6000 loads of Scotch potatoes was made by England in the form of a loan for production, thereby making the cultivation of potatoes once more possible in Austria. It was also expected that by this means a regeneration on a large scale of Austrian potato cultivation might be effected. While the original object of the re-establishment of potato production was successfully achieved, the latter attempt ended in failure. The imported kinds included Up to Date, King George, Edzel Blue, Arran Comrade, Arran Victory, etc., and with the exception of Up to Date which had been grown in Austria for ten years past, degenerated so completely that scarcely any seed potatoes of these varieties were obtainable. An official enquiry showed that they had for the most part lost their productivity, a proof of the fact that in the case of potatoes, any considerable changes in the conditions under which they are grown are followed by deterioration in their yielding capacity. The Up to Date variety is still grown. H. K.

Fibre Crops.

308. The Outlook for Flax Fibre and Linseed.

I. The Outlook for Flax. *South African Journal of Industries*, Vol. VII, VII, No. 7, pp. 473-475. Pretoria, 1924.

II. Linseed Selection Experiments in India. *Nature*, Vol. 113, No. 2850, p. 472. London, 1924.

III. Flaxseed Production, *North Dakota Agricultural College, Bulletin* 178, pp. 43, tables 19. North Dakota, U. S. A., 1924.

IV. Acreage of Linseed in U. S. A. *Journal of Department of Agriculture, Irish Free State*, Vol. XXIV, No. 1, p. 72. Dublin, 1924.

The shortage of cotton supplies and consequent high prices have given a stimulus to the linen industry, as to-day flax fibre is the cheaper raw material. The imports of flax and tow into Belfast this year show a great advance over those of 1922-23, but are still far below the amount imported in 1913. In pre-war days Russia exported 300,000 tons of fibre, whereas now the total is probably not more than 20,000 tons. In 1920 Canada's fibre area reached 31,300 acres, but owing to low prices, has decreased; prices have now improved and the area is increasing. In 1922 Kenya exported 2000 tons, which amount could be greatly exceeded (1).

Flax at £100 per ton is a remunerative crop and the market price is not likely to be lower for some years.

In India the crop is grown for the supply of soil seeds and work has

(1) See *R.* 1924, No. 63. (*Ed.*)

been carried out in the hybridisation and selection of plants from Indian strains, some of which have given promising increases in yield of seed.

In the United States flax is chiefly grown for linseed oil production, and North Dakota yields about one-half of the total output. The two chief problems have been wilt (*Fusarium lini*) and weeds. Varieties resistant to wilt have been developed and are now available, e. g., N.D.R. 114 and N.D.R. 52, of which the former is highly wilt resistant. Weed growth is lessened by sowing flax in rotation after a crop giving a clean cultivation. Mixed crops of flax and wheat are grown to some extent as the practice encourages early seeding, controls weed growth and is easy to harvest. The linseed crop for 1923 in the United States was estimated at 19,400,000 bushels, an increase of 66 % over that of 1922, but is still 50 % below the requirements of the country. W. S. G.

309. **Cotton in Brazil and the International Conference at Rio Janeiro, 1922.**

I. *Annals da Conferencia Internacional Algodoeira*, Rio de Janeiro, 1922.

Vol. I. O Algodão do Brasil a Conferencia Mundial Algodoeira de Nova Orleans, pp. 293-312 (DEOCLECIO DE CAMPOS).

Vol. II. O Interesse da Industria Allemã no Algodão Paulista, pp. 323-334 (OSCAR G. MORS); A Industria Algodoeira em São Paulo, pp. 335-345, (OCTAVIO PIPO NOGUEIRA); Necessade da Especificação Algodoeira nas zonas Culturaes da Parahyba, pp. 273-393 (GETULIO A. CESAR); O Rio Grande do Norte Algodoeiro, pp. 413-439 (ANTIDEO GUERRA).

II. *Brazilian Cotton*, pp. 211-212. ARNO S. PEARSE, Manchester, 1922.

III. *Cotton in North Brazil*, p. 147, ARNO S. PEARSE, Manchester, 1922.

IV. *Extrait du Rapport de M. le Prof.* G. ROSSATI sur la Conference Cotonnière Mondiale de la Nouvelle-Orléans. Institut International d'Agriculture, 1919-1920.

V. *Classes and Committees of the World Cotton Conference*, New Orleans 1919 (Instructions for the use of Delegates to the Conference).

VI. *The Cotton Growing Countries*, p. 13, Brazil. International Institute of Agriculture, Rome, 1922.

Cotton in Brazil, Rio Janeiro Conference. — Many are the cotton growing countries, present and potential; some are very active and important, some have possibilities, but have not yet shown any very conspicuous results. Brazil occupies a high position on the active list, in regard to quantity of output, and at the same time holds out the promise of great future development.

After a journey through most of the cotton growing districts of Brazil, Mr. Arno PEARSE, the Manchester Cotton Expert, in an address at Rio Janeiro, in August 1921, made the following statement:

" The area suitable for cotton cultivation in Brazil is larger than that in the United States, and the conditions of climate and soil are probably more favourable to cotton cultivation than in any other part of the world ".

This is another way of saying that in the possibilities of the exten-

sion of its cotton growing, Brazil has no serious competitor. The United States already produce about two-thirds of the world's cotton, but adverse circumstances forbid any considerable further extension of area. Thus with climate and soil alike favourable in large tracts of country, the future belongs to those who guide the destinies of Brazil.

International cotton conferences have been latterly frequent, and have varied in interest and importance according to the selection of suitable locality. Some of the more recent meetings have been dignified by the title of "World's Cotton Conference" as at New Orleans in 1919 and at Manchester and Liverpool in 1921. From the very fact of their respective sorroundings, these World Conferences differed greatly in their outlook; the first was held at the gateway of the North American cotton belt, where the preponderant interests were those of growers, ginners and exporters, the other conferences took place far from cotton fields, in the great Lancashire cities where the cotton bale is among the most familiar of objects, but where very few of the inhabitants could recognize a cotton plant if they saw it.

The British Conferences were concerned almost entirely with the manufacturers' point of view, with trade questions, with the standards as a basis of contract, with matters of finance. Growers and exporters from many parts of the world were present, but the cotton traders of Lancashire predominated in number and in influence.

Cotton questions took on quite another complexion at the Congress held in the splendid City of Rio Janeiro amid sorroundings of the greatest interest to European visitors, and, even more important, on shores where cotton has long been the prime factor in one of the chief industries. Here, under the southern tropic, the North American cotton man and the Lancashire spinner were equally strangers and the atmosphere was completely changed.

The International Cotton Conference of Rio Janeiro was held in October 1922, under the auspices of the Government as represented by the President of Brazil in person, and by the Ministers of Agriculture and of Foreign Affairs; it was carried through by Conference members well qualified to guide opinion.

Among the subjects proposed for discussion were included:

(1) A general Review of cotton growing in Brazil and in other countries;

(2) Costs incurred and prices obtained, also measures for aiding the industry;

(3) Means for improving Brazilian cotton growing;

(4) The cotton of north-eastern Brazil;

(5) Improvements in handling picked cotton and the by-products;

(6) Intensification of cotton growing; proposal for Federal Government support;

(7) Classification and formation of standards of cotton and types of by-products;

(8) Spinning, weaving, domestic consumption, exports of cotton goods;

(9) Financial credits ;

(10 Exporting cotton and by-products, shipping, charges, rates of freight.

The broad bases of the World Conferences at New Orleans and Liverpool have been briefly indicated and in the statement submitted at Rio by M. DEOCLECIO DE CAMPOS (Annals, Vol. I, p. 293) material is given for an interesting contrast between the New Orleans and the Brazilian Congresses.

M. DE CAMPOS has quoted details of the New Orleans programme and conclusions ; the subjects were as follows :

(*A*) World requirements of cotton ; increased consumption demands increased production ; stabilization of prices ;

(*B*) Production, selection, of seed, methods of cultivation and of picking ;

(*C*) Ginning, uniform baling and compression ;

(*D*) Warehousing and damage before shipment ;

(*E*) Transportation and insurance ;

(*F*) Buying and selling, equitable tare, net weight ;

(*G*) Exchange, classification, contracts, speculation ;

(*H*) Financing, foreign credits, exports ;

(*I*) Research, reports, and statistics, national and international ;

(*K*) Organization of the Cotton Conference on a permanent basis adapted to all cotton interests.

Here there is a different view from that typified in the Rio programme. New Orleans begins with a world-wide survey of cotton supplies and requirements, a position much less accentuated in Brazil. At Rio there is much to be said on Federal inspection in furtherance of more scientific methods of growing ; in North America the principal inspection discussed refers to classification, and has since resulted in the establishment of Universal Standards for United States Cotton. One point of similarity may be noticed, the growers are exclusively interested in their respective crops, hardly at all in those of other countries.

At New Orleans a strong recommendation, addressed to all cotton growing countries, was made in favour of a uniform system of statistics relating to cotton yields, imports and exports, and of improvements in the methods of collecting and transmitting these data, and it was proposed that all data should be communicated immediately to the International Institute of Agriculture in Rome. The Institute has made good use of the facilities recommended, as cotton is one of the principal crops now discussed in the Institute's monthly and quarterly Reviews and in periodical monographs, such as " The Cotton Growing Countries " (Rome 1922).

In order to minimize the loss occasioned by bad weather and exposure the New Orleans Conference insisted strongly on the necessity of sufficient storage in close proximity to ginneries.

There was also much discussion on methods of financing the American cotton crop ; the establishment of credits on uniform bases was recommended for the consideration of bankers and financial agents. M. DE CAMPOS dealt very fully with statistical improvements in his statement, giving

examples of the methods adopted by the International Institute of Agriculture. The spreading of knowledge concerning agricultural science, and more particularly of scientific cotton growing, cannot fail to be encouraged by the parallel dissemination of exact statistics, embodying the results obtained by improved methods of cultivation.

The safeguarding of the harvested crop is a point of equal importance in North and South America, and in proportion to an increased annual yield in Brazil, the necessity for adequate protection from weather damage becomes more urgent. This question has been included in the statement of M. DE CAMPOS, as indeed have all the material points made at New Orleans. Some few were of merely local interest, and some such as the question of revised classification and Universal Standards have been transformed from recommendations into accepted facts.

At the Rio Conference several members contributed papers on cotton growing in north-eastern Brazil, and furnished many interesting details as to the production of high-class cotton in that region, which is in many respects the most important. Mr. ARNO PEARSE has also made a special study of these plantations in his "*Cotton in North Brazil*". Mr. PEARSE is insistent on the necessity for adequate irrigation in this area under the torrid equatorial sun, and has based his argument on actual observation; he gives an account of what has already been accomplished by the provision of lake reservoirs, as well as what actually remains to be done in the cotton growing districts.

M. Antidio GOMEZ, Delegate from the Cotton Departments of the States of Parahyba and Rio Grande do Norte, furnished much detailed information on the various species grown under his inspection. In the Agreste, or Littoral, in the low-lying lands near the ocean, is found the shorter-stapled *Gossypium herbaceum*, always an annual; further inland, in the Matta Zone, among the first range of hills, the Quebradinho cotton thrives on the drier soils, with varieties of *herbaceum* still persistent in the more moist districts; the Caatinga or Catinguera is a higher zone of country, and here the perennial Quebradinho predominates. Again, at a still higher level, the Sertão is reached, subdivided into the Baixo Sertão of the river valleys and the Alto Sertao of the plateaux. Sertao is also the generic designation of the many varieties of long staple perennial (or tree) cotton grown, including Verdão Inteiro, Quebradinho and the much prized Mocó. Last of all the Seridó is reached, the real home of the best Brazilian Cotton, where *Gossypium Vitifolium* (Moco) is grown to great advantage on gravelly soil, in the many valleys and on the hill slopes. The staple of Mocó is from 1 $^{1}/_{8}$ to 1 $^{3}/_{4}$ inches (32 to 45 mm); this variety of cotton is not infrequently employed for mixing with Egyptian, in manufacturing processes. Seridó and Sertão first grade (primeiras) are picked from July to January. Matta Cotton is picked from September to February. Cotton exporters from this region were the first to classify by staple and grade, selecting "primeiras", "medianas" (seconds) and "refugas" (rejections or waste).

With a view to summarizing in convenient form the information supplied by M. GUERRA, the writer has also made reference to Mr PEARSE's

account of Brazil and her cotton potentialities (*Cotton in North Brazil* p. 147).

A large number of ginneries (in 1922 396), are to be found in all the cotton growing and cotton exporting districts of North Brazil, the most important being in the upper country of the Seridó, where the perennial cotton is prolific. During the years from 1919 to 1922 nearly all the cotton arriving at the port of Natal (Rio Grande do Norte) was exported coastwise to Rio Janeiro and Santos (Tables by M. GUERRA following his paper above mentioned).

In any consideration of Brazilian cotton-growing, special mention must be made of the Southern or São Paulo crop, which was discussed in some detail by M. OSCAR MORS, and M. OCTAVIO MAGUERA at the Rio Conference.

São Paulo is the largest individual Cotton producer among the States of Brazil, though the aggregate yield of the southern crops including Minas Geraes State is on the average not more than 25 % of the entire production of the country. It differs in quality from the majority of the north-eastern cotton, having been raised originally from American seed, while the staple corresponds with " Upland " as a rule, though it is occasionally somewhat longer. Picking in São Paulo takes place between March and May, in contrast with that in the north-east, which continues from July to March. It is only for a very short time during the year that cotton picking is not in progress in some part of Brazil.

That some considerable advance has been made in cotton growing in Brazil is clearly shown by the following figures :

Yield of ginned cotton (lint) in Brazil.

Years of picking	Thousand pounds
1015-16	134,901
1916-17	134,114
1917-18	164,720
1918-19	161,921
1919-20	183-441
1920-21	189 332
1921-22	200,523
1922-23	264,300
1923-24	275,300
1924-25	289,100

It can hardly be doubted that the Rio Conference of 1922 has had a great influence on Brazilian cotton production. The data for the last three seasons were communicated by the Government on February 20, 1925.

J. H. H.

310. **Research in Relation to Cotton Cultivation.**

Experiment Station Record, Vol. 50, No. 8, pp. 701-708, Washington, D. C., 1924.

The increasing disposition to look to organised experimentation to solve agricultural problems becomes more and more evident. An example

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of this is shown in the great work now being carried out in the British Empire to promote cotton production, and the reliance placed on research. The world is threatened with a shortage of this raw material and an attempt is being made to meet the demand.

Since 1900 consumption has increased faster than production. The decrease in Egypt has been ascribed to reduced soil fertility, poor drainage, inadequate fertilizing, pink bollworm and other pests and agrarian disturbances. In the United States the main causes of the decline in yield have been the spread of the boll weevil and labour shortage.

The policy of developing a cotton supply from the British Empire itself has been steadily gaining in favour, and in 1902 the British Cotton Growing Association was formed. The Association was granted a royal charter in 1904; financial assistance was given by a number of local governments and grants made from the Imperial Treasury. Where several years ago grants were made from the Treasury of between £600,000 and £700,000, for the Colonies of Nigeria, Nyasaland, Uganda and the West Indies, in 1921 these were almost all cancelled, chiefly because of increased revenues from cotton growing.

The principal cotton fields are India, the Sudan, Nigeria, Uganda, Nyasaland and the West Indies.

In 1917 the Empire Cotton Growing Committee was appointed to advise the Government as to the best means of developing the growing of cotton. The report of this Committee, given in 1919, recommended the enlargement and strengthening of the agricultural departments in the colonies and the establishment of a central research institute and of a bureau of information. In order to train scientific men in the study of cotton the creation was advised, at British Universities, of readerships in plant physiology, genetics, mycology and entomology and the institution of research scholarships, to be held by graduates.

To establish a permanent body to carry out these recommendations the Empire Cotton Growing Corporation was formed under royal charter in 1921. It includes representatives of the Governments of England, India, South Africa and Australia, of the cotton industry at home and in India, of chambers of commerce, of the British Cotton Growing Association and other bodies interested in cotton. It has an income partly derived from a capital contribution of nearly £1,000,000 made by the Government, and partly from a leavy of 6d. per bale on all raw cotton purchased by spinners in England.

Special reports have been drawn up on the possibilities of development of production in Nigeria, Nyasaland, Tanganyika, Western Australia and Queensland. Assistance of a practical nature has been given to the Sudan Government, and Sir John RUSSELL and Dr. Martin LEAKE visited the Sudan to advise on the organisation and direction of agricultural research in connection with irrigation projects in the Gezira, near Khartoum. It is expected that 100,000 acres will be under cotton in 1925.

Grants are made for scholarships to universities and institutions for research in connection with cotton.

The Imperial Institute in London has, since 1903, been a clearing

house for information on cotton, and has published reports and papers on cotton production, and carries out investigational work on cotton fibres and samples of cotton soils.

The field of technology has been given attention to by the British Cotton Industry Research Association, incorporated in 1919, which has research laboratories at the Shirley Institute, Manchester. Studies are made of the botanical, chemical and physical properties of the single cotton fibre, knowledge of which is fundamental to the entire industry. The need is felt of purely scientific work, in order to understand the many problems.

The work has naturally centred, to a large extent, on India, which with an ouput of 4,000,000 bales is second only in production to the United States.

In 1917 the Indian Cotton Committee was appointed, and in 1921 the Indian Central Cotton Committee, which in 1923 became a permanent body. Apart from its more formal duties, the committe is charged with the promotion of all measures which will improve the Indian cotton industry.

A central agricultural research institute has been established on a site given by Indore and supported by annual subsidies from the Central Indian States, as Indore is well situated for cotton investigations.

Taken collectively, the work now in hand probably constitutes one of the largest organised enterprises ever undertaken for a single commodity.

W. S. G.

311. Manuring for Cotton Production.

BLACKSHAW, G. N. (Chief Chemist, Department of Agriculture, Rhodesia). *Rhodesia Agricultural Journal*, Vol. XXI, No. 5, pp. 539-542. Salisbury, Rhodesia, 1924.

Cotton can be grown on many varieties of soil, but the land must not be too rich, or vegetative growth is encouraged at the expense of fruit. Land which will yield more than eight bags of maize per acre is inclined to be too rich for cotton, whereas soils which are incapable of giving six bags in a normal season should generally be given a dressing of fertiliser for cotton.

The following scheme of manuring is suggested:

Sandy soils of good type; 200 lb. of high grade superphosphate per acre.

Sandy soils of poor type: 100 lb. of a complete fertiliser, containing 4 % N, 20 % soluble P_2O_5, 6 % K_2O per acre.

Light sandy loams of good type: 150-100 lb. high grade phosphate.

Light sandy loams of poor type: 75-100 lb. of complete fertiliser, containing 4 % N, 20 % soluble P_2O_5, 6 % K_2O.

Heavier soils: 150 lb. high grade superphosphate per acre.

Farmyard manure hinders ripening of the crop and is not recommended.

W. S. G.

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312. Growing of Pima and Upland Cotton in Arizona.

COOK, O. F. and MARTIN, R. D. *United States Department of Agriculture* Bulletin No. 1432, pp. 14, figs. 6. Washington, D. C., 1924.

The Bulletin describes the methods used in growing cotton in the Salt River Valley, Arizona, including the selection and preparation of land, planting, thinning, irrigation, cultivation and harvesting of the crop. The information has a general application to the irrigated districts where cotton is grown in New Mexico, Arizona and California. Attention is drawn to the necessity of using the roller type of gin for Pima cotton, although more time is taken and the expense is greater than when a saw gin is employed. W. S. G.

313. Sisal-Hemp on the Gold Coast.

Tropical Life, Vol. XX, No. 12, pp. 180-182, plates 2. London, 1924.

The chief product exported from the West African Gold Cost is cacao, grown mostly in the forest regions. Between the coast and the forest areas is a broad belt of land which is too dry for cacao and has hitherto been neglected.

In 1920 the Government commenced the planting of 1000 acres of this land with sisal (*Agave sisalana*), which was completed in 1922. The plants have grown well and have been free from disease. The rainfall is about 25 inches, and falls generally in tropical showers, and no difficulty is experienced in drying fibre, even in the wet season. A factory has been erected and a light railway laid down. The complete installation, including machinery and houses for Europeans and native staff cost about £35 per acre.

The first cutting took place in July 1924, and the yield from the leaf was 3.5 % of dry, brushed fibre. The planting distance is 7 × 7 feet, nearly 900 plants per acre, and the average yield from first cuttings 15 cwt. per acre.

The total cost per ton of fibre, based on one month's work was £18, but it is expected that these figures will be decreased ; it is estimated that a further cost of £4 per ton for transport to the European markets will be incurred. Shipments of about 40 tons have already been made.

W. S. G.

Other Industrial Crops, chiefly Tropical.

314. The Coconut Palm in Indo-China.

GUILLAUME H. in *Bulletin économique de l'Indochine*, Year XXVII, No. [illegible], II. 1924, No. 157-164, and No. 166, III. 1924, pp. 266-323, with many photographs, plans and maps (forming a special supplement).

This report might be described as an " Introduction to the study of the coconut palm in Indo-China ". A complete account of the various problems which arise in connection with this palm would require several years' work, a whole series of local observations and experiments, a thorough

knowledge of the various improvements carried out in neighbouring countries, and their value from the point of view of application to Indo-China.

This report represents a preliminary step towards such a complete study. After describing the cultural conditions demanded by the biological requirements of the coconut palm and its geographical and economic environment, the methods which should in consequence be adopted for increasing and improving its cultivation are suggested. In this connection copious reference is made to the experience gained in other countries. Recommendations are also made as to the administrative measures that should be adopted with the object of initiating and encouraging the development of the cultivation of the coconut palm.

The author then discusses the following questions: the world trade in copra; the origin and distribution of the coconut palm in Indo-China, which is grown on 28 000 to 30 000 hectares in the country of which 17 000 are in Cochin-China; the cultivation of the coconut palm in relation to the climate and soil of Indo-China; the varieties of this palm in general and in Indo-China in particular; the diseases to which it is subject, whether already known in Indo-China or not as yet known, but capable of being introduced; the sanitary regulations for the palm adopted in Cochin-China, Annam and Cambodia (Ministerial Order of 19 June 1914); cultivation of the coconut palm in Indo-China by natives and by Europeans; crop and yield, composition of the nuts; manufacture of copra, desiccated coconut and other industries; manufacture of oil; use of the coir, shell and milk; various other uses; cost and value of certain products of the coconut palm in Indo-China: estimates of planting for the native and the European types of cultivation; conditions necessary for the extension of the cultivation of the coconut palm and the various means whereby it may be encouraged. (Indo-China Corr.)

315. Use of *Caesalpinia Sappan* L. for Tanning.

VIGNOLO LUTATI. La *Caesalpinia Sappan* L. per l'industria della concia. *Annali R. Accademia di Agricoltura di Torino*. Vol. LXV pp. 10: Turin, 1922.

Id. id. Sulla concia coi frutti di *Caesalpinia Sappan* L. e sulla morfologia loro e dei Tari. *Mercurio, Rassegna mensile illus. di Studi applicati al commercio*, Year III. pp. 11, tables 3. Turin, 1920.

The *Caesalpinia* genus, of the Cesalpiniacea family, has numerous useful species; some supply woods for carving and dyeing, others yield essential oils, edible fruits and fruits rich in tannin, used in tanning and dyeing (*C. coriaria, C. digyna, C. brevifolia, C. Paipae*).

The author has received from Sardinia, where it grows luxuriantly in the University Botanical Gardens at Cagliari, leaves and fruits of *C. Sappan*, hitherto known only from the fact that the wood is used in various work and because a red dye is extracted from it; the trade name is Sappan or Japan wood, although it also comes from India, Siam, China and Malacca; but its use for tanning was not known.

The greater part of the pods examined were incombustible; there

is practically no tannin in the seeds, which are few and there is a greater yield of tannic matter from the pods without seeds, weight for weight, than from those with developed seeds.

The pods seem quite smooth, but actually there are unicellular hairs irregularly distributed over them which vary in colour from straw-yellow to orange-red and brown. Similar hairs are found on divi-divi, and algarobillas (the fruits of *Caes. coriaria*, *C. digyna* and *C. brevifolia*). The leaf is compound and has as many as 10-12 pairs of leaflets, obliquely oval and oblong, with pointed apex, 3-5 cm. long and 1.5-2.5 cm. wide.

In the estimation of the tannic material the results were as follows:

	Total extract	Non-tannic	Tannic
Fruit	52.2 %	18.1 %	44.1 %
Leaves	42.5 %	23.4 %	19.1 %

These data prove that the Sappan fruits are very rich in tannin, almost as rich as those of the divi-divi, and algarobillas. While divi-divi renders leather plaint and durable, it imparts a reddish colour which lowers the value of the leather, in consequence of which other and more expensive tanning materials must be used (nut-gall, mirobolans) and extracts from oak and fir bark, in order to avoid the undesirable colour; only the algarobillas render leather flaccid. Divi-divi on the other hand is free from these defects and has good tanning properties, without colouring the leather. The tannic extract of the Sappans acts like that of the divi-divi and causes the same fundamental reaction.

C. Sappan seems very well adapted to climatic conditions in the south of Sardinia and has proved to be very drought resistant and could therefore be cultivated on the dry chalky hills where certain other plants would not grow. The tree flowers all the year round, but the principal harvest could be gathered in the dry season, when the product could be best prepared rapidly and at the lowest cost.

The propagation of such trees in southern Sardinia and other regions under similar climatic conditions would furnish a source of excellent tanning material, which has now to be imported.

The fruits of Sappan and divi-divi are similar: if the pods bear seeds, those of the former contain a larger number (5) than the others (2-4); there are other differences in the microscopic structure, viz., in the stomata, their position and the number of unicellular hairs on the valves.

The reactions with concentrated sulphuric acid and lime water enable the sappan to be distinguished from the divi-divi and algarobillas.

In his second work the author gives an account of hide-tanning tests made with sappans. The tests were made on calf-skins with the tannic matter extracted from the pods by the PROCTER method.

Four tests were made:

A — hides tanned with pure sappan
B — » » » sappan and quebracho
C — » » » sappan quebracho und chestnut
D — » » » piclata, chrome and sappan.

The results were satisfactory; all the samples had an excellent appearance and were of a clear and uniform colour, and did not contract (especially sample A) or stretch. The author therefore considers that *C. Sappan* should be cultivated in Italy and the Colonies.

Sumach leaves are highly valued for the clarity of their extract; to produce an equal clarity with sappans double the tannic matter content is required.

The author gives a series of photomicrographs, which unfortunately are not very clear, showing distinctive botanical characters such as the varying number of stomata and the unicellular hairs already mentioned.

F. C.

316. **Rubber in Indo-China.**

P. CARTON in the *Bulletin économique de l'Indochine*: Year XXVII, No. 167, IV, 1924, pp. 349-456, with numerous photographs, plates and maps, published separately).

History. The production of rubber has become one of the most important of Indo-China, as a result of the marked and rapid development of the plantations of *Hevea brasiliensis* in South Indo-China. The introduction of the cultivation of this species is one of the most important events in the economic history of the French colonies: it is the first and most perfect example of cultivation on modern lines undertaken on a large scale in these colonies, and, in spite of the innumerable initial difficulties, it has succeeded beyond all anticipation.

The history of the production of rubber in Indo-China may be divided into three phases:

1. production of forest rubber from lianas;
2. experiments in the cultivation of different rubber plants, the two phases not being separated in time but overlapping one another;
3. the production of rubber from *Hevea.*

A brief sketch is given of each of these three phases.

Trade. — The author gives a short account of the world production of rubber, so that an idea may be formed of the relative importance of the production of rubber in Indo-China.

In 1830, the consumption of rubber amounted to 400 tons only. In 1840 NELSON GOODYEAR invented the process of vulcanisation: and it was only after this important discovery that rubber began to be generally utilised. In 1850, 1,400 tons of rubber were produced and consumed; in 1860, the consumption amounted to 2 300 tons: in 1870, to 5,000 tons; in 1880 to 8000 and to 12,000 in 1890.

In 1900 the production rose to 53 400; this was followed by a very slight general increase with certain fluctuations rising slowly to 75,150 tons in 1911. After that, in consequence of the steady development of

the production from plantations of Asiatic Hevea, the increase became very marked and rapid.

1912	100,500 metric tons		1918	301,300 metric tons	
1913	110,200 » »		1919	332,000 » »	
1914	122,300 » »		1920	349,200 » »	
1915	161,200 » »		1921	298,700 » »	
1916	204,800 » »		1922	409,600 » »	
1917	269 900 » »		1923	405,800 » »	

Although a French Company was formed a few years ago for establishing a rubber industry in Indo-China, nearly the whole of the rubber produced in Indo-China is exported. Hence a complete idea of the production can be gained by a study of the exports as shown in the *Rapports annuels sur la navigation et le mouvement commercial de l'Indochine* of the Administration of Customs and Revenue (the figures for 1898 to 1904 have been taken from "*Le Caoutchouc en Indochine*" by C. and A. SPIRE).

In 1898, nine tons of forest rubber was exported.

In 1899, 51 tons were exported, nearly all coming from Laos and shipped at Haiphong, and a very small quantity only, viz., three and a half tons, at Saigon.

In 1900, the exports rose to 339 tons of which 300 tons were shipped at Haiphong and 39 tons at Saigon.

In 1901 there was an export of 266 tons, 190 by Haiphong and 76 by Saigon.

In 1904, the export dropped to 177 tons, 164 by Haiphong and 13 by Saigon.

Up to 1918 the exports were small, as the trade was only in the forest rubber and in the output of the first small plantations:

1911	245 tons	1915	377 tons
1912	285 »	1916	546 »
1913	214 »	1917	[illegible] »
1914	195 »	1918	531 »

Then quite suddenly as the result of the tapping of the heveas of the large plantations, the exports showed an immense increase:

1919	2,976 tons	1922	[illegible] tons
1920	3,142 »	1923	5,696 »
1921	3,648 »		

Rubber producing lianas. — The author mentions all the rubber producing lianas known in Indo-China, although they now have merely a historic interest. Special studies were made of these plants at the time when expectations were founded on them, by the botanist PIERRE, by HEIN, HECKEL, JUMELLE, SCHUMANN, QUINTARET, C. and A. SPIRE, G. ACHARD, VERNET, CAPUS, BREUGNOT, P. CONTET and YERSIN.

Ficus elasticus and other plants. — Great hopes were at one time placed in *Ficus elasticus*, but for some time past its cultivation has been abandon-

ed. None of the experiments made with other plants (*Castillea elastica, Manihot Glazowii, Tenongia tonkinensis* Stapf, *Bleekcrodea tonkinensis* Eb. and Dub.) gave any permanent result.

Hevea brasiliensis. — The author deals successively with the following subjects :—

1. A botanical study of *Hevea.*
2. An account of the latex.
3. A comparative ecological study of the environmental conditions of the Amazon region and of the Far East, with a longer description of the various conditions of South Indo-China (range of climate, soils, etc.), in relation to *Hevea.*
4. Development of the cultivation of *Hevea* in Indo-China. This cultivation has been developed to a remarkable extent in Cochin-China. On 30 June 1923, nearly 33,700 hectares were under *Hevea*, and the number of trees planted on this area was nearly 8,300,000 of which upwards of 4,800,000 were being tapped. The greater number of the plantations are distributed in the eastern provinces or rather those in the North-East; the provinces of Thodaumont, Bienhoa, Giadinh, Tayninh and Baria.

In Cambodia the area planted in Hevea is still rather limited, and on a rough calculation only 1200 hectares were planted in the region of Kompong-Cham in 1923. But large concessions have been made to important trading companies which certainly take an active part in the production of rubber.

In Annam, the surface planted in Hevea was only 690 hectares in 1923, in the region of Bhatrang.

5. Methods of cultivation.
6. Tapping. In particular a study of alternate tapping, by G. G. Vernet and H. Girard.
7. Coagulation of the latex.
8. Rubber yields.
9. Diseases of Hevea in Indo-China, (few and unimportant), described by F. Vincens.
10. Selection of Hevea.
11. Economic considerations.

Conclusions — At the end of the article the following conclusions are drawn :— French Indo-China has been but little affected by the recent crisis in the world industry of rubber production. Apart from some plantations of secondary importance which were established at the time when the local exchange was extremely high, even in comparison with gold, the small and average-sized plantations under really careful management as well as the large plantations with considerable capital funds have been able to surmount all the difficulties of the situation. During the acute stage of the crisis, profits could only be made by the plantations where the method of alternate tapping had been adopted; most of the others with their unscientific methods have experienced considerable losses during this period. Government assistance was however forthcoming taking the shape of bounties on exportation and encouragement of mortgage loans.

As M. Auguste Chevalier said in 1921 : " There is a great future be-

fore the Cochin-China hevea plantations and they are capable of great extension. There are still virgin lands of immense extent not yet taken up which are fertile and easily accessible and where successful plantations could be made. An urgent appeal is hereby addressed to the capitalists of the mother-country for their assistance in bringing these lands under cultivation. At the same time this advice may be given to the planters of Cochin-China. Do not be content to plant only hevea. Side by side with the rubber-tree which will be for the moment the main crop, lay out a number of the plots of your concession in other crops such as cocoa-nut, coffee, tea, palm or sugar-cane :... so as to be in a position, in case at any time there should be no market for rubber, to undertake the cultivation of crops which may possibly be more remunerative after the lapse of some years ". (Indo-China Corr.).

317. **Stick-lac in Cambodia.**

Renseignements du Bulletin économique de l'Indochine, February 1924, p. 78. Hanoi, 30 April 1924.

The demand for this product is increasing on the Pnompenh market. The prices ruling (110 piastres per 100 kilogrammes) are an encouragement to future growers, and it is obvious that a rapid development of production is likely. In accordance with a resolution of the Chamber of Commerce and Agriculture, the Agricultural Department is organising the extension of the production of shellac ; it is proposed in particular to consign to private individuals at certain fixed periods swarms of the lac insect for placing on the trees.

Up to the present only one application for such a consignment has been made in the Kampong-cham Agricultural Division. In the month of October 1923, M. CHOUPOT, Sub-Inspector of Agriculture, selected a plot of land with trees suitable for the reception of the swarms for the purpose of farming an experimental plot for the production of shellac and also of swarms of the lac insects.

An order was placed on the Laos market for the necessary swarms (50 kg.) and they were supplied from Bassac where a native agent was sent to fetch them. All the arrangements were made in advance ; small baskets for the swarms were collected, the trees freed of brushwood and all parasites removed, and thus the treatment of the trees could begin at once. Up to the present the development of the insect colonies has proceeded normally.

It appears from information supplied by the District Heads that the natives are beginning to understand that it is to their own interest to respect when making their clearings, the different kinds of trees which are suitable for treatment.

In view of the production of shellac there is a tendency to encourage the establishment of systematic plantation : plantations of shellac yielding trees which receive regular attention, undoubtedly yield a better supply than that generally obtained by gathering in the forest. (From the Report of the Resident in Cambodia, 1923).

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318. **Requirements for Sugar Production.**

WATTS, SIR FRANCIS (K. C. M. G., D. Sc.). *Tropical Agriculture*, Vol. I, No. 6, p. 81. Trinidad, 1924.

The Author draws attention to the fact that sugar production differs essentially from that of crops such as wheat, in that it is a manufacturing as well as an agricultural industry. The manufacturing side imposes heavy restrictions as regards costly machinery and technical supervision. For these reasons beneficial State, or other measures do not produce the immediate response seen in the case of cereals.

During the past 25 years there has been a steady evolution from small plantations with small plants, to central factories of very large capacity. In the West Indies, under the former system, 13 or 14 tons of cane were required to produce one ton of sugar, whereas under modern methods about 9 tons gives the same yield of sugar.

The necessity to produce under modern conditions has caused those places which cannot adopt large scale methods to disappear, as sugar centres. This has actually occurred in Dominica and Montserrat, hence the apparent decrease in total output of sugar in the West Indies On the other hand, the economic basis of production has been improved. These changes have been accompanied by the expenditure of large sums of money on sugar machinery.

It is not sufficient for statistical purposes to judge output over a small period of time. The cultivation of sugar is perennial rather than annual, owing to ratooning. Only by the most careful study of the circumstances underlying changes indicated by trade statistics, can correct deductions be made. W. S. G.

319. **Light and Air in the Modern Cultivation of Sugar Cane.**

ROSENDEFELD, H. A. (Tecnólogo Especial para caña, Estación Experimental Insular, P. R.). *Revista de Agricultura de Puerto Rico*, Vol. XII, No. 4, pp. 237-247, tables 3. San Juan, 1924.

The author considers that this is a once discredited theory which is again being advanced. Mention is made of the different experiments made in connection with this subject and the stripping off of leaves as a source of light and air is discussed. The recent discussions on separate sowings are studied and a short summary of tests in planting at various distances is given, accompanied by an account of experiments carried out (1910-1916) at the "Estación Azucarera de Tucumán" (Sugar Station at Tucuman) on the *Cheribon Morada*, the P. O. J. 36, the 213 and the 228 canes; the Uba, and the Java variety Zwinga were also tested; experiments were made as to yield per hectare as related to spacing in planting.

The author tabulates the results of 17 croppings with P. O J. 36 and 213, Uba and Zwinga.

The author states that, after carefully examining the question in all its aspects, and taking into consideration the results obtained throughout the sugar producing world, it may be concluded that the sugar-cane

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should be sown as closely as is consistent with adequate cultivation modern implements. The best spacing distance appears to be ab 5 feet for large types of cane such as the Cheribon, Lahaina, B. 208, H. B. H. 10-12, S. C. 12(4), etc. and 5 $\frac{1}{2}$ to 6 feet for the more leafy rieties, such as the P. O. J. of Java and the East Indies. E. M.

320. **Present situation of Sugar-cane Cultivation and of the Su Industry in Cochin-China.**

PRÊTRE, H. and GUILLAUME, P. *Publication du Gouvernement de la Coch chine*, 79 pages, map. Saigon, 1924.

The authors discuss the importance of the sugar-cane in world pr duction and its future in the French colonies; the cultivation of the s gar-cane in Cochin-China (varieties, native cultivation, pests, cost pri and selling prices) — the sugar refining industry in Cochin-China, inclu ing present position, native sugar factories, European sugar factor

The article as a whole makes it clear that although Cochin-Chi is at present backward in sugar production, it is certain that it will ever tually become a great and profitable centre for the sugar refining i dustry, and that there is nothing to prevent such a development.

(1) From the point of view of cultivation, the country is particular suitable for growing the sugar-cane, and the poor yields obtained ar not due either to the temperature, nor the rainfall, nor to the type o soil (which when once under treatment responds well), nor to disease but solely to the methods employed, which are of a routine characte and are not based on a thorough understanding of the subject.

(2) From the industrial point of view, success may be confident anticipated, as it had already proved possible to obtain excellent rum and white sugar of high quality.

It is important at the present juncture to establish a scientific in stitute for special work on questions relating to sugar, as has been don in Java and Hawaii.

The authors have attempted to set out certain considerations that might induce capitalists, whether French or native, to invest their funds in the sugar-cane industry and have pointed out that:

(a) cultivation of the sugar-cane and sugar refining, taken sepa rately, and a fortiori in combination, were remunerative for the native, in spite of the defective methods followed and of the employment of an entirely rudimentary equipment;

(b) the Dutch and the Americans have been most successful with the sugar industry in their colonies, owing to the adoption of scientific methods;

(c) there is no chance of achieving similar results in Cochin-China, unless definite use is made of modern methods which naturally require progressive action and a large capital backing;

(d) the sugar crisis, like the rubber crisis, gives no real cause for alarm, in view of the continued increase in world consumption and the large demand for sugar in Europe and in the Far East.

In conclusion, they lay stress on the two following facts which are both highly important :

The sugar cane, being an annual, gives a return from the end of the first year, which means that the capital sunk in the industry is quickly realisable, that is, if the shareholders are not so unreasonable as to demand high dividends in the first years, and also makes possible the rapid extension of the plantations.

If the shareholders are careful to form the business capital in piastres (and it is here that the co-operation of Chinese-Annam finance may perhaps be of value), the exchange cannot influence the working of the industry until the point of saturation of the local and the Far East market is reached, which is not within sight for many years.

No other important colonial crop except rice offers the same advantages : rubber, coprah, coffee, cotton, oil palm, etc. are grown under widely differing conditions. Sugar-cane yields much more per hectare than rice and the local market price of sugar is more stable than the price of rice. Moreover, during the early years, with a duty placed on sugars imported from Hongkong, Singapore, Java, etc., there would be no foreign competition to be feared in Cochin-China.

In conclusion, everything points to the development of the cultivation of sugar-cane and of the sugar refining industry in Cochin-China and this promising French colony may in time, if it chooses, take a place among the principal sugar producing countries of the world.

(Indo-China Corr.).

321. **Tobacco Fertilisers.**

BEETS A. N. J. Bemestingsproven 1919-20, 1922-23. *Proefstation voor Vorstenlandsche Tabak*, Mededeeling No. L, p. 66, 1924.

The following are the results of the tests made with various fertilisers:

Lime. Its value as a fertiliser in heavy soils is shown by the good results obtained at Dijoewiring.

Dessa earth and stable manure. They have a considerable and beneficial influence on the total yield, the length of the leaves and the quality of the crop, but may, in certain surroundings, cause infection by *Phytophthora nicotianae*.

Ammonium sulphate. Has no effect on length of leaves if applied when the soil has been fertilised with Dessa earth and stable manure, which are necessary for light soils and which cannot be substituted by sulphate of ammonia.

Nitrate of soda. The above remarks also apply to this fertiliser.

Urea. Urea contains up to 45 % of nitrogen and would be more economical than sulphate of ammonia. Compared with the latter, on light soils it gave sometimes better, sometimes similar and sometimes inferior results.

Phosphates. The results did not indicate that a better yield was obtained by the application of phosphates.

Tobacco-seed cake. This cake gave good results, comparable to

those obtained with Dessa earth and stable manure. In practice, however, it is not possible to obtain a sufficient quantity for plant requirements.

Ground-nut cake gave good results as regards length of leaves.

Guano (from bats) contains too low a percentage of nitrogen to be suitable.

A. F.

322. **Tobacco Cultivation in Ukraine.**

POPOFF. Vidrodgenia i soutchasni stan ukrainskoi tutunovoi promislovosti. *Vistnik Silsko-Cospodarskoi Naouki* (1), Vol. III, liv. 1-2, pp. 21-26. Kharkov, 1924.

The author gives a statistical review of the tobacco industry in Ukraine and shows that after a period of depression, it has begun to recover appreciably since the year 1923.

The War and subsequent events affected the cultivation of this plant much more than the manufacture of its products, the factories having been able to continue work for some years on the stocks of leaf-tobacco which had been accumulated. The area of tobacco plantations, which before the War covered as much as 26 thousand hectares, had fallen in 1921 of 100 hectares. In 1922, half the factories which had survived, 6 in number, were united in a Trust, partly under State control and this new organisation undertook to infuse new life into the production of the raw material. From the year 1923 onwards, the Trust arranged to sow 6000 hectares and to encourage private planters by financial advances; it was hoped that in this way cultivation would be revived over about 10 thousand hectares, and that a crop of about 250 000 q. of leaf-tobacco could be obtained. It should be noted however that this tobacco is of a special kind, and resembles neither the American tobacco (for cigars) nor the Turkish type of tobacco (for cigarettes). The greater part of the tobacco cultivated in Ukraine (especially in the Provinces of Chernigoff and Poltava) belongs to a very coarse species, with thick, giant leaves, known in Russian as "makhorka"; it is used only as a pipe tobacco, by the peasantry and the poorer classes of the towns people. The Turkish types of tobacco are in Russia only cultivated in large quantities in the Crimea and Caucasus regions, which are outside the Ukrainian Republic. A certain quantity of the Turkish type of tobacco, however, is cultivated in the Ukrainian province of Podolia, and the author remarks that recently the cultivation of this type is beginning to spread also in the Provinces of Chernigoff and Poltava.

The author draws attention to the importance of tobacco cultivation, which, in his opinion, should become one of the principal branches of agriculture in Ukraine, there being a tendancy everywhere to intensify cultivation and increase crop production.

(1) Journal of Agricultural Science, published by the Scientific Agricultural Committee of Ukraine.

323. **The Habit of Budded Cacao.**

HARLAND, Prof. S. C. and PARGA, R. G. *Tropical Agriculture*, Vol. I, No. 9, pp. 132-133. Trinidad, 1924.

The Cacao tree grown from seed has two kinds of branches, which differ in the arrangement of their leaves: these are, the main axis type or chupon, and the fan or palm type, known in Trinidad as the "jorquette". The cacao tree is thus dimorphic in its branching system.

These facts led the authors to study whether the prevailing habit of budded cacao is due to the type of bud used for budding, and it was found that buds are always taken from fans and not from chupons. The conclusion reached was that monomorphic (fan) trees result from the use of buds from fans.

Experiments were then carried out on the River Estate of the Trinidad Department of Agriculture to ascertain under what conditions if any, a dimorphic type of budded cacao could be produced. The experiments showed that, fans when pruned generally produce fans from the topmost bud and any others which may develop. It is, however, possible for fans to produce chupons. Out of 59 pruned fans, 57 gave fans, and 2, both from the same tree, gave chupons. Chupons generally gave rise to chupons, and from a close examination of pruned chupons which gave fans it was concluded that there was no clear case of a chupon which had already forked, producing a fan after being pruned below the fork.

From these experiments it is clear that if buds are taken from chupons instead of from fans, an entirely different sort of tree will result.

Which of the two types is agriculturally the better should now be the subject of further investigation.

W. S. G.

324. **The Qualities in Cacao desired by Manufacturers.**

The Journal of the Jamaica Agricultural Society, Vol. XXVIII, Nos. 2 and 3, pp. 64-67. Jamaica, 1924.

Many growers of cacao would be assisted by knowing what qualities in cacao are considered desirable by manufacturers of cocoa and chocolate, and the following notes have been written with a view to supplying that information.

In gathering the crop, the planter should take care that only ripe pods are picked. This would be facilitated by planting one variety only on a plantation. If gathered too soon the beans are small, flat and tough and the shell is difficult to remove, also, unripe beans do nor ferment normally. Over-ripe beans ferment rapidly, the shells are fragile and the roasted cacao is inferior in quality.

Beans which have germinated give an inferior final product, with a herbal odour and an astringent taste ; even a small percentage of such beans is objectionable.

Unfermented cacao is always saleable, but at a lower price, as the final cocoa is inferior in colour, odour and flavour. Lack of cleanliness

during fermentation causes objectionable flavours, and the same result is caused by exposure to bad odours.

After fermenting, it is usual in some countries to remove the pulp by washing. This practice leaves the shell thin and fragile and renders the cacao more liable to insect attack, also, the unwashed product is said to keep better.

It is essential that beans should be throughly dry before packing. Sun-drying is preferable to artificial drying.

The product should be freed from shrivelled beans and rubbish ; waste should never exceed 0.5 %.

Claying improves the appearance, but the practice is open to abuse, e. g., using more than 1 % of clay or masking black cacao from diseased pods, by claying.

Dancing and polishing improve the appearance of the beans, but it is doubtful whether it is worth the extra cost.

Large beans are preferred to small beans as they have a lower percentage of shell.

Manufacturers object to flat beans because they shell less evenly, have a greater percentage of shell, do not roast so evenly, and are usually evidence of unripeness, or insufficient fermentation or careless drying.

Cacao moths should be kept away from the cacao while drying, or their eggs are deposited on the beans, into which the larvae eat their way.

Probably the most highly appreciated character is constancy of quality ; careful grading would result in higher market prices.

W. S. G.

325. Opium Experiments in Spain (1).

BENAIGES DE ARIS, C. (Prof. at the Higher School of Agricultural Experts). *Ingeniería y Construcción*, Nos. 15 and 16, pp. 127-268, figs. 5. Madrid, 1924.

The author first describes the reasons which led him to take up the study of opium and the agricultural difficulties, and the possibilities in Spain of specialising the most varied crops.

The tests were made by the author from 1915-1918 at the experimental and demonstration grounds of the "Granja Escuela práctica de Agricultura" at Valladolid. The characteristic features of the fields are: height 700 m., frequent winds, those from the north being cold and those from the south-west deprived of moisture ; minimum temperature from —5 to —6°C. ; total precipitation under 350 mm. (in the years 1917-18, 286 mm.) ; evaporation 4-8 times the precipitation as estimated by the instruments for measuring rainfall.

In these conditions tests were made on the white opium poppy, *Papaver somniferum*, and on the obtaining of opium. In the village of Mojados (Valladolid) the opium poppy was already available, as its capsules and

(1) See R. No. 937, 1924. (*Ed.*).

seeds are exported for oil extraction; in Spain opium poppy-seed oil is not used.

The price of opium during the test years was 50-300 pesetas per kg. owing to its great scarcity, which induced the author to undertake the experiments.

At first the experiments were made on dry, loose, sicilious soils; plots were sown at the end of September. The result was negative because all the conditions were unfavourable. Only on one lot, in which the plants were slightly protected, did the severe frosts (8 and 12°C.) not have the same effects as on all the others, which were exposed.

In the district of Mojados the opium poppy is cultivated in low-lying, sandy, clay-lime soils. Though dry, they are better than those of Granja. The subsequent experiments made by the author were carried out on the moist soils of Granja.

After these first trials, the author experimented in the moist zone: (1) On sandy and very moist soils; (2) On sandy-clay soils.

1) *On sandy and very loose soils.* — The author describes all the operations carried out, commencing with sowing on the 15-16 April, until the harvest on 17-27 June. Sowing was done in three ways: broadcast; scattering on hilly ground; in drills on the plain. The last gave the best results, for it allowed cultivation of the soil during the growth period, after each rainfall, with the light plough patented by the author and which he uses for his "double row system" in surface dressing for wheat.

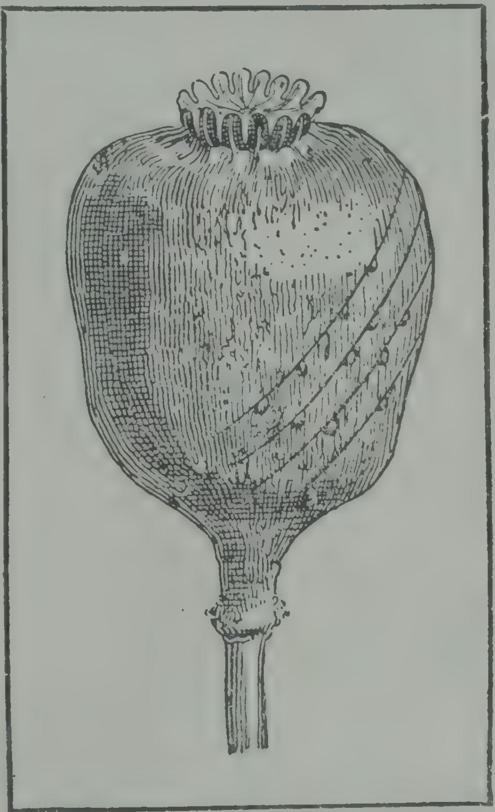

FIG. 93. — Opium poppy capsule with four diagonal incisions from which exude drops of opium. The opium is collected with small spatulas and dried in the sun in suitable vessels, in which form it is sent to the market.

Incisions were made in the fruits one by one (Indian fashion) by hand with small knives (Fig. 93), so that the cuts did not penetrate the epicarp. This process is slow and the yield is small. Three series of incisions were made: the first gave about 8.48 kg.kg. of opium per ha.; the second, 5.38 and the third, 2.69 kg. The opium from the 1st incision contained 10.5 %, of morphia, and that from the 3rd, 7 %: 45 % of oil was extracted from the seeds.

The opium thus obtained was costly and the economic yield of the opium poppy small.

2) *On sandy-clay soils.* — These are better than the preceding ones for cultivating the opium poppy. The latter was introduced in the follow-

ing rotation: 1st year, peas; 2nd. year, opium poppy; 3rd year, broad beans; and 4th year wheat.

In this test the seed was sown in double rows. There was a distance of 50 cm. between the single, and of 70 cm. between the double rows. The plants in the rows were about 20-30 cm. apart. The sowing was done in March with small drills. The author gives all details relating to preparation of the soil — manure — watering — thinning-out — gathering.

Under the heading "Means tried for reducing cost of gathering" the author gives some interesting data. In the first tests, made by means of incisions with knives, 39 days of 6 hours each were required for 30 000 capsules, or 128 capsules per hour, and a period of 175 days per ha. As the date of the harvest coincided with that for cereals, labour was scarce and dear.

It was necessary to increase the yield which was done by the adoption of straight incisors (in the Persian style) instead of single knives. These did not give good results because they cut the capsules only at the tangential points, and the knives soon lost their edge. The author then devised the jointed scarifiers (Plate XLV, Figs. 94 and 95) the knives of which adapt themselves to the irregularities of the capsules, and make 5 incisions at a time. The scarifier is easily taken to pieces. The knives have a saw-like edge and hence be come less clogged. With these scarifiers incisions were made in the 30 000 capsules in about 70 hours, or 429 capsules per hour and about 88 days were required per ha. In gathering the opium, time to the extent of over 50 % is economised by using separate receptacles, the author however says that the time must be greatly reduced in order to make the process of industrial value.

Conclusions drawn from these tests. — (1) The white Armenian opium poppy grows well in the climate and soils of Spain; (2) in the Castillian table-land (the characteristic features of which are the same as those of the Granja de Vallodolid) the yields of opium poppy capsules are as much as 1 500 kg. per ha. In the Granja the following was obtained on an average: 17 686 gms. of opium with 10.91 of morphia and 1472 kg. capsules, with 725 kg. of seed, per ha.; (3) the morphia yield from the first incision (scarification) was 11.13 %; (4) in very sandy soils the opium does not thrive, moisture (in Spain) being indispensable. The best yields were obtained on the sandy-clay, and somewhat limy, soils; (5) sowing should take place as early as possible; 4-5 kg. of seed should be sown per ha. at a depth of 1-1 $^1/_2$ cm.; a thin layer of farmyard manure or straw and a small amount of water favour growth; (6) spacing varies according to climate, and the rows should always be in the direction of the prevailing winds; (7) second dressings are always very advantageous; (8) the plants should be thinned out and superfluous flower-buds nipped off; (9) it is advisable to carry out scarification before the fruits lose their bluish colour and become brownish; (10) the greatest yields are obtained on calm and warm days, hence plantations should be protected from cold winds; (11) the greatest difficulty with regard to this cultivation in Europe is the obtaining of labour, hence it should be reduced as far as possible in the following way: (a) by gathering as early as possible so that this period

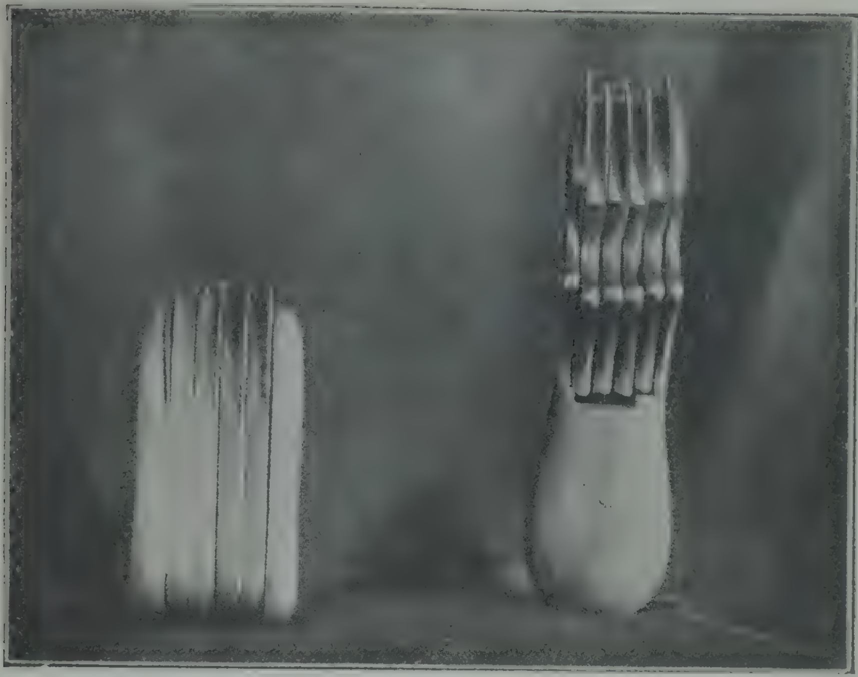

FIG. 94. — Tool with jointed blades adjustable to the irregular surface of the poppy capsules; used for making incisions; side view.

In the model shown on right the fore-finger is placed on the projection of the handle, in such a way that the blades adjust themselves to the capsule.

The model on left is held between the thumb and middle finger; the fore-finger is placed on the back of the handle. The two models were made for the experiments described in the article.

FIG. 95. — Tool with jointed blades for making incisions in opium poppy capsules. Front view of author's model.

does not coincide with that of the ordinary harvest; (*b*) by reducing the number of capsules per ha. and increasing the size and yield by selection and the use of fertilisers; (*c*) by facilitating harvest operations by grouping in double rows with pathways between; (*d*) by utilising female and child labour, jointed scarifiers, and individual containers for collecting the opium. (12) It would be well to study methods for obtaining the opium or the morphia only from the newly pulled plant by certain physical or physico-chemical processes, without destroying the value of the seed.

The author concludes by drawing attention to the uniformity of the product and believes it would be well to form associations for the production of commercial standard types, under State control, like tobacco, and for the packing in casks and furnishing with a guarantee based on analysis, in order that the opium of the West may meet with favour on the market.

E. M. F.

Horticulture and Arboriculture.

326. **The Production of Pineapples.**

Tropical Agriculture, Vol. I, No. 6, pp. 85-86. Trinidad, 1924.

The article gives a brief account of the pineapple industry, with special reference to Hawaii, where in 1903 the output was only 1893 cases, whereas the estimated output for 1925 is 10,000,000 cases. Great development has also taken place in Florida, Cuba and the Azores.

Two instances of failure are discussed, the first being that of Florida, where the industry was almost extinguished, although now revived. This failure was due to exhaustion of the soil humus and to wilt, or red wilt associated with a parasitic root nematode, the attack of the worm perhaps being due to plant weakness caused by soil depletion. To avoid soil exhaustion proper cultivation and manuring must be given; areas which are infested with the nematode can be freed by growing two or three crops of Natal grass, and certain varieties of cow peas, on the roots of which the nematodes cannot live.

Some years ago a set-back occurred in Trinidad, but in this case it was due to inadequate experience in canning and distribution, which requires more knowledge of organisation and more capital than does the production of the pineapple. Standardized packing and crating is essential.

The success in Hawaii has been largely due to mass production, propaganda and advertising.

The « Red Spanish » variety is one of the best for shipping as fresh fruit, whereas Smooth Cayenne is the variety most grown in Hawaii for canning; in Cuba the Sugar Loaf variety is grown for local use.

The article concludes with a description of methods of canning employed in Hawaii.

W. S. G.

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327. Practical Advice on Long Pruning.

MESTRE A. (Director de la Estación Enológica de Felanitx, Mallorca). *El Cultivador Moderno*, Year XIV, No. 11, pp. 10-11, 3 photos, 2 illus. Barcelona, 1924.

The author describes the object of pruning, systems of pruning, principles of plant physiology applicable to pruning, choice of a system of pruning, increased yield obtained through long pruning, kinds of long pruning of which a trial is recommended, long spiral pruning, Costet long pruning and Floret long pruning.

Bearing in mind certain principles of plant physiology the author concludes that the object of pruning is "to obtain a maximum of fruit to the detriment of growth energy, at the same time however maintaining sufficient energy to avoid weakening the stock". For this reason the choice of the system of pruning cannot be made in a very general way, but each stock must be considered individually. Not all varieties lend themselves to a particular system of pruning; long pruning must be applied on deep soils, and other factors must be borne in mind such as soil fertility and fertilisers.

The following results of tests at the Enological Station at Villafranca de Panadés were obtained by long pruning:

Xarel-lo Variety — grafted on Aramon × Rupestris No. 9.

Year	Short pruning — Production per hectare	Long pruning — Production per hectare	Notes
	kg.	kg.	
1911	1 059	16 127	In the year 1911 the spring frosts completely destroyed the crop on the short-pruned lot. On the other hand little damage was done to the long pruned crop because the shoots were farther from the soil. The year 1914 was characterised by drought; owing to careful cultivation, long pruning was applied without detriment to the stocks. Note the low yield in 1915 owing to severe attacks of mildew.
1912	4 634	28 344	
1913	7 840	23 613	
1914	7 421	15 593	
1915	4 509	20 349	
1916	7 332	22 500	
1917	9 006	23 721	
Average	5 971	21 184	

Intensive production through long pruning somewhat reduces the alcoholic strength of the wines. From the *Xarel-lo* variety grafted on *Aramon × Rupestris No.* 9 the alcoholic strengths were 11.6 % after short pruning and 11.1 % after long pruning.

From the *Subirat Parent* on 1202, the strengths were 12.7 and 11.6 respectively.

The author recommends that in each vineyard the vine-grower should set aside a small part of the vines, some isolated stocks, for pruning tests.

Nothing would be lost thereby and on the other hand he might

PLATE XLVI.

FIG. 96. — System of long pruning tried in the Experimental Field of the Enological Station at Felanitz (Mallorca).

Subirat Parent Variety, grafted on Mourviedro × Rupestris No. 1,202.

Year	Short pruning — Production per hectare	Long pruning — Production per hectare
	kg.	kg.
1912	9 953	29 127
1913	7 491	22 340
1914	4 681	10 860
1915	7 029	17 121
1916	8 715	21 358
1917	8 299	23 986
Average	7 689	21 310

benefit considerably. The GUJOT, ROYAT, SYLVOZ and CASENAVE, are systems of long pruning, but are not advisable, except in rare cases, owing to their costly installation and to the necessity of establishing them as soon as the vineyard is planted.

The author recommends the Costet-Floret and *long spiral system*, in preference to those systems in which not all the vineyards can be treated in the same way. The ideal of the vine-grower should be to produce high yields at a low cost, rather than to cultivate many plants.

At the Enological Station at Villafranca de Panadés, 21,500 kg. per hectare were obtained on dry soil. A. M. F.

328. **Plane Tree Investigations.**

BRETZLER R. Beiträge zur Kenntnis der Gattung Platanus. *Botanisches Archiv*, Vol. VII, Parts 5-6, pp. 388-417. Königsberg, 1924.

The author deals chiefly with the differentiation of the various species of plane-trees, basing on the dispositions and behaviour of the reproductive organs. G. B.

LIVE STOCK AND STOCK BREEDING.

General.

320. **Damage caused by the Golubatz Fly in Roumania: its Attacks on Animals and Man.**

CIREA, T. (Professor of Pathology, Faculty of Veterinary Medicine, Bucarest) and DINULESCU, G. (Veterinary Captain in the Roumanian Army). *Annals of Tropical Medicine and Parasitology*, Vol. XVIII, No. 3, pp. 323-342, plates 3, 1 map, figs. 8, bibl. Liverpool, 1924.

In Europe, one of the greatest sources of Simulies is the Golubatz fly, which, in Yugoslavia, originates from the Departments of Pojarewatz and Craina, and in Roumania, from the Banat Departments of Timis, Torontal and Caras-Severin.

From these breeding-grounds, in the spring of nearly every year, the Golubatz fly invades some of the Departments of Transylvania and Oltenia, in more or less dense swarms. The inhabitants of these Departments are well acquainted with the fly and the means for protecting the livestock, and so the damage is not great.

But in 1923 two swarms of Simulies left the Department of Caras-Severin, and directing their course, one towards the north and the other towards the east, invaded 17 Departments of Roumania, or one-eighth of the total area of the Country; at the same time 7 Departments of Yugoslavia and 3 of Bulgaria were invaded. An examination of the map of the area invaded shows that the fly followed a course at right angles to that of the water-ways, which indicates that they were carried by the wind. The Simulies are transported shorter distances by accompanying the animals they desire to attack.

According to official information, during the invasion, the Golubatz flies in Roumania killed 16,474 domestic animals, viz., 1585 horses, 60 asses, 10,592 cattle, 28 buffaloes, 915 sheep, 460 goats and 2814 swine.

In Yugoslavia 1552 animals were killed, and in Bulgaria, in the Department of Widin, they destroyed 1500 animals. The value of the latter was 63,050,000 lei (1), to which should be added the losses caused by the cessation of agricultural work which resulted.

It was observed that the punctures were mortal only during the first 4 or 5 days of the invasion; the authors believe that a certain state of immunity was established in the animals which had escaped a first attack.

The Golubatz fly settles on the body of the animals, especially on the mucous of the natural orifices and on the most delicate parts of the skin; it buries its proboscis deeply in the skin and remains fixed there

(1) 800 lei = 75.15 Fr. francs in 1923 = £ 1. 0. 0.

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until gorged with blood. The animals bitten start and take to flight, enter the water, or go into the stables. Those with a black coat are attacked more than the others.

The flies are aggressive from sunrise until 10.0 a. m. and from 4.0 p. m. until the evening; during the middle part of the day and the night they remain hidden.

Blood oozes from the punctures, which, according to their number, form bleeding patches of varying extent; when the bites are numerous, a hard and painful inflammatory oedema is formed.

The animals which are severely bitten show symptoms of imminent asphyxia and death ensues after a few hours. When the attack is less violent, the symptoms are less accentuated, lasting 6-7 days, and then death follows. The typical position assumed by the animals attacked is the sterno-abdominal decubitus. At the autopsy, congestions and degeneracy of the heart, liver, kidneys, etc. are noticed.

The preventive measures are: on the arrival of the fly, to keep the animals in dark quarters during the day, and send them out to pasture or work during the night. In order to prevent the flies from entering the stables, burn dung near the door. To protect the animals while grazing or at work during the day, raise smoke round them.

Dress the most vulnerable parts with preparations of absinthe, walnut, hazelnut or tobacco leaves, also mineral or vegetable tar with rancid hog's lard or ordinary hog's lard.

As curative measures, massage, poultices of brine or brine and vinegar, ammonia lotions, cold baths and ice are used.

As internal remedies, the following cardiac tonics are used: infusions of coffee and fox-glove and injections of caffein. Bleeding is also resorted to.

The veterinary surgeons state that many animals which had been severely stung by the fly were slaughtered and their meat was consumed without danger.

The authors investigated the attack of the Golubatz fly on man, and described the general and local symptons, the treatment and prophylaxis.

P. D.

330. Influence of Insulin and Glucose on Milk Secretion and Composition.

NITZESCU, I. I. and NICOLEAU, C. (Institute of Physiology of the Faculty of Medicine, Roumanian Biological Society, Cluj Section). I. Influence of Insulin on Milk Secretion. *Comptes rendus des séances de la Société de Biologie et de ses filiales*, Vol. XCI, No. 37, pp. 1462-1463. Paris, 1924. II. Influence of mono- and disaccharides, in an intravenous injection, on the composition of milk. *Ibidem*, p. 1464, Paris 1924.

I. — The object of the investigation is to observe the variations in milk composition under the influence of sub-cutaneous injections of insulin.

The tests were made on two ewes, in full milk, separated from their lambs.

For more than a month before and throughout the test, the ewes were kept on strict rations; one received 1 kg. of oats and 2 kg. of dry hay daily, the other, fresh hay *ad libitum*. They were milked 3 times a day, at 8 a. m., 12 and 8 p. m. The insulin was injected sub-cutaneously in the ewes at 8 o'clock in the morning, after the first milking; the glycemia was determined in the jugular blood before the injection, and 2 and 4 hours after, and the next morning before milking. After 2 or 3 days the injection of insulin was repeated. The test led to the following conclusions:

(a) *Quantity of milk*: as regards the first ewe, the quantity of milk from the 3 milkings showed about the same variations on the day the insulin was given as on the days without insulin. As regards the second ewe there was a slight decrease after the injection of insulin, especially at the evening milking; this decrease seemed to continue the next day.

(b) *Fat*: The percentage of fat, which even in normal conditions fluctuates greatly between one milking and another, often show a slight increase after the insulin.

(c) *Lactose*: The percentage of lactose is remarkably constant on the days without insulin. After the injection it decreases, especially in the evening milk; the decrease continues, but to a less extent, the next day. It must be observed nevertheless that the decrease is rather slight when the hypoglycemia is considerable, and that the lactose is still reduced when the degree of glycemia has again become normal.

(d) *Nitrogen in the casein and total nitrogen content of the milk*: Slightly and irregularly influenced.

(e) *Inorganic phosphates*: after injection, slight increase of mineral phosphate in the evening's milk; this increase even continues to a slight extent the next day.

II. — Modifications in milk secretion after intravenous injections of glucose and similar compounds.

The experiment was carried out on the same ewes as in test I, with same feed and same times of milking. On the third day of the test, glucose (30-40 gm. in 100 cc.) was injected into the jugular vein the morning after the first milking. After 2-3 days there was a second injection (60-80 gm. of glucose) and after 1 or 2 days, a third. The following were also injected: levulose, galactose, maltose and saccharose (1-2 gm. per kg. of live weight in 100-150 cc.).

The quantity of milk and the fat content show the same variations on the days of injection from one milking to another as on the other days. The lactose undergoes unimportant modifications, even during considerable hypoglycemia or after copious injections of glucose.

The lactose in the blood is therefore distinct from that of the mammary gland.

The results of tests I and II prove that the mammary gland retains an evident autonomy as regards lactose secretion and produces this secretion in a very constant manner in spite of wide glycaemic variations.

P. D.

331. **Influence of Light Rays on Calcium Content of a Normal Growing Organism.**

LESNE, E., TURPIN, R. and ZIZINE, P. *Comptes rendus des séances de la Société de Biologie et de ses filiales*, Vol. XCI, No. 37, pp. 1378-1379. Paris, 1924.

In order to investigate the influence of light on the total calcium content of a normal growing organism, the authors divided a litter of 6 rats into 2 lots: 3 of these animals were subjected, 15 days after birth, and for 15 minutes daily, to the rays of the quartz-mercury lamp; the other 3 rats were used as controls and not subjected to the rays.

All other conditions were identical for the 2 lots.

After 30 applications the total calcium content of each lot was ascertained, and the following results were obtained:

	Lot 1 (irradiated) gm.	Lot 2 (control) gm.
Total weight	143	134
Ca as oxalate (total)	3.684	3.168
Ca as metal (total)	1.151	0.990
Ca per 100 gms. of the animal	0.865	0.739

These figures show the eutrophic influence of the rays of the quartz-mercury lamp on the development of a normal growing organism and the parallel variations of the total Ca content; they lead one to foresee the successful application of artificial light in the preventive treatment of rachitism and a tendency to spasms. P. D.

332. **The possible Significance of Exose Phosphoric Esters in Ossification.**

ROBINSON, R. and SOAMES, K. M. (Department of Biochemistry and Experimental Pathology of the Lister Institute). Part. I. The possible significance of exose-phosphoric esters in ossification. Part. II. The Phosphoric Esterase of Ossifying Cartilage. *The Biochemical Journal*, Vol. XVIII, Nos. 3-4, pp. 740-754, 2 plates. Cambridge. 1924.

DAVENPORT, KAY H. and ROBINSON, R. Part III. The Action of the Bone Enzyne on the Organic Phosphorus Compounds in Blood. *Ibidem*, pp. 755-764.

The phosphoric esterase discovered by one of the authors (ROBINSON) in ossifying bones and cartilages, is found in the same proportion also in the teeth, especially of young animals. This enzyme quickly hydrolyses the exoso-monophosphoric and glyceroshosphoric esters, liberating phosphate-ions. The greatest hydrolytic power however is possessed by the liver, spleen and pancreas, while the non-ossifying muscles and cartilages are quite deprived of it.

The optimum P_H for such enzyme is found on a curve between 8.4 and 9.4 in a zone, that is favourable to the precipitation of tri-calcium phosphate and calcium carbonate.

The enzyme in the bones may be differentiated from that in the pancreas, liver and spleen, in that it has comparatively no influence on the phosphoric esters.

The deposit of phosphate of lime in the bones taken from rachitic rats and immersed in a solution of exosomonophosphate and glycerophosphate of lime at 37°, with P_H 8.4-9.4, has been proved by experiment. These tests lead one to conclude that the hypothesis that this enzyme takes an active part in ossification, is well-founded, and prove that it is secreted in the osteoblast region and that of the hypertrophic cartilaginous cells. The high P_H might be attributed to some mechanism which renders the fluid more alkaline than blood and thus favours the action of the enzyme.

The organic phosphoric compounds soluble in acid existing in the blood of various animals, are formed of at least two phosphoric esters, one of which is rapidly hydrolysed by the enzyme of the ossifying cartilage and the other resists the latter. The quantity of esters thus hydrolysed reaches 14-36 % of the total phosphorus soluble in acid.

These esters are in the corpuscles but not in the plasm. When the bone extract acts on the whole of the blood, it increases the quantity of inorganic phosphorus in the plasm, which probably indicates that the esters can spread from the corpuscles to the plasm.

The phospholipin in the blood is not hydrolised by the enzyme in the bone. A. F.

333. **Changes in the Chemical Composition of the Tissues of the Herring in relation to Age and Maturity.**

BRUCE, J. R. (Marine Biological Station, Port Erin). *The Biochemical Journal*, Vol. XVIII. Nos. 3-4, pp. 469-485, bibl. Cambridge, 1924.

The author has chosen as a criterion in judging of the age of the herring, the winter rings, and has selected for examination examples homogeneous as regards sex and maturity.

It was found that at a certain stage of sexual maturity, the water fat and protein content depend on age, inasmuch as the older fish have a lower percentage of water and protein and a higher percentage of fat.

Sexual maturity has the same influence on composition as age. It was observed indeed that individuals at the same stage of sexual development, arranged according to increasing age, show similar variations in the proportion of water to fat and in the protein content, as individuals in successive stages of sexual development, but presumably of the same age. The older and larger herrings, with a full development of spawn and "milt", have greater nutritive calorific value than the younger fish, even when mature.

The metabolic requirements for the growth of the sexual glands are mostly satisfied by the fat reserves of the liver; the muscular tissue is not touched unless for a very short time before spawning.

The sexual glands also need phosphorus and phosphatic compounds

(lecithin, etc.), which are important in the changes which take place in the tissues at the time of sexual maturity. A. F.

334. **Stimulating Influence of Vitamine Preparations on Growth.**

KRIZENECKY, J. and PODHRADSKY, J. (Institute of Zootechnical Research at Brno, Chekoslovakia). *Revue de Zootechnie, la revue des éléveurs,* Year 4, No. 1, pp. 31-36, graph. Paris, 1925.

In the authors' researches on vitamines, they have observed their action when above the necessary normal minimum, beyond which pathological troubles begin; they have tried to determine the higher limit, the physiological optimum of the effects due to an increase of vitamines.

The quantity of vitamines in the rations is increased by the aid of vitamine preparations, thus rendering it unnecessary to overload the organism with superfluous quantities of nutrient substances.

1st Test: Made with 6 white mice, including males and females of the same litter, weighing, after weaning, from 3.4 gm. to 4.3 gm. For a week they received rye-bread and wheat and barley meal; they were afterwards divided into 2 groups of 3, weighing respectively:

1st group; 4.52, 31.80 and 4.50 gms (test group)
2nd » 5.56 4.49 and 4.75 » (check group).

The test group received, in addition to the above ration, small pieces of bread dipped in a water solution of the product to be tested. Each mouse thus received about 0.03 gm. of the dry matter of this product per day. The mice were weighed daily or every other day for 22 days. The influence of the product was shown and caused an increase of 32.7 % more than that of the other group.

2nd Test: on 4 young male rabbits of the spotted Czechoslovakian breed from the same litter, aged 14 weeks.

They received oats and green food; 2 of them also had a vitamine product, with which the oats had been moistened, to the extent of 5.5 gm. per day. After the test had been carried on for 92 days, the following results were obtained:

Check rabbits				Rabbit receiving vitamine products			
Initial weight	Final weight	Increase in weight	Increase in % of initial weight	Initial weight	Final weight	Increase in weight	Increase in % of initial weight
kg.	kg.	kg.	%	kg.	kg.	kg.	%
0.865	1.570	0.705	81.5	1.215	3.970	2.755	155.14
1.125	2.260	1.135	100.89	0.950	2,970	2.020	213.63

The average stimulating effect on growth is thus 59.95 %.

3rd Test: at the poultry farm at Potstyn on poultry of the Bresse and Faverolle breeds, various preparations, Z_1, Z_2, Z_3, being used.

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The groups compared were formed of 5 young pullets and 5 young cocks of each breed ; 1 gm., and later 2 gm., of the products were added to the ration per day per bird.

The feed common to all groups was :

(1) a mixture of flour ($^2/_7$), wheat bran ($^2/_7$), crushed maize ($^2/_7$) and bone and meat powder ($^1/_7$) ; one part of the mixture was in the form of a paste, the other was dry and given without limit ;

(2) maize meal, morning and evening, in quantities of 25, 35 or 45 gm. according to the progress of growth.

Increases in weight after 40 days, in % of initial weight.

	Bresse		Faverolles	
	Cockerels	Pullets	Cockerels	Pullets
Check groups	192.99	191.07	168.61	184.24
1st group tested with Z_1 . .	220.68	217.95	203.53	228.47
2nd » » » Z_2 . .	199.08	204.45	206.81	188.03
3nd » » » Z_3 . .	203.26	207.32	168.45	184.01

Conclusions :

(1) The product Z_1 has always had a stimulating effect on growth ; the increased weight of the fowls as compared with those which did not receive the product was 25 % for the Bresse cockerels and 23 % for the Bresse pullets, 15 % for the Faverolle cockerels and 23 % for the pullets.

(2) The product Z_2 did not stimulate growth to a marked extent except in the case of the Faverolle cockerels.

(3) The product Z_3 did not stimulate growth.

(4) The stimulating effect of Z_1 may be expressed as the decrease of time necessary to obtain the same weight ; this decrease, with respect to the weight reached by the check group at the 122nd day, is 26 and 30 days for the Bresse groups and 42 and 49 days for the Faverolles. This is an economy of feed equal to the strictly necessary ration for 37 days on an average.

(5) The increase in growth due to Z_1 continues beyond the period during which it was given as a supplement ; it is therefore a case of a reinforcement of the vital processes and an increase of the nutrient exchanges.

(6) The results cannot be interpreted as the consequence of an insufficiency of vitamines in the ration of the check groups, for no pathological phenomena took place.

(7) Similar results in the case of farm stock other than poultry would be of considerable economical importance.

P. D.

335. **Antirachitic Properties imparted to Inert Fluids and to Green Vegetables by Ultra-Violet Irradiation.**

HESS. A. F. and WEINSTOCK, M. (from the Department of Pathology, College of Physicians and Surgeons, Columbia University, New York). *The Journal of Biological Chemistry*, Vol. LXII, No. 2, pp. 301-303, Plates 8, bibl. Baltimore, 1924.

Various inert fluids were irradiated with a mercury vapour lamp, in order to ascertain if it were possible, by this means to impart to them antirachitic properties.

The authors found that cottonseed and linseed oil could thus be rendered specifically active.

After irradiation, these oils, at the rate of 0.1 cc. per day, were capable of protecting rats, receiving a rachitigenous diet, from rachitism. Consequently an antirachitic factor has been produced *in vitro*, independently of the action of any living organism. The irradiated oils were able to store and keep this antirachitic factor for a long period of time.

Wheat, etiolated by being grown in the dark, possesses no antirachitic properties, whereas, when cultivated in the open air and irradiated with a mercury vapour lamp, it can protect rats, subjected to a rachitigenous diet, from rachitism.

The same difference as regards their protective influence against rachitism was observed in the case of green vegetables subjected to irradiation after being gathered. Green lettuce leaves have no preventive properties, whereas after irradiation they possess antirachitic properties.

This shows that the production of an antirachitic factor is completely independent of growth phenomena and due to irradiation. During their tests, therefore, the authors have, by irradiation, produced an antirachitic factor, both *in vitro* and in growing plants.

P. D.

336. **The Size of Animals and the Laws of Bergmann and Dépéret.**

REINSCH B. Das Dépéret Gesetz und die Regel von der Kleinheit der Inselformen als Spezialfall des Bergmannschen Gesetzes und ein Erklärungsversuch desselben. *Zeitschrift für induktive Abstammungs und Vererbungslehre*, Vol. XXXV pp. 136-155. Leipzig, 1924.

According to BERGMANN's law, among animal races the larger types live in the colder and the smaller in the warmer climates, the law being based on the principle of the economy of heat in relation to size.

The law of DÉPÉRET declares on the contrary that in the race development of the animal kingdom, there is a progressive increase in size and that in other words the race lines began with the small types and finished with the large.

In the author's opinion the law of DÉPÉRET is merely a special case of the law of BERGMANN, if allowance is made for the climatic variations bound to occur before the third stage of descent is reached.

G. B.

337. Modification of the Coat in Mammals.

KRÖNING F. (Zoolog. Institut der Universität Göttingen). Über die Modifikabilität der Säugerscheckung. *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Vol. XXXV, Part 2, pp. 113-138, 21 illustr. 1 plate, bibl. Leipzig, 1924.

For investigation of the inheritance of the marking of the coat in mammals the study of double, exceptional forms, is of great use, from the point of view of ascertaining the symmetry of the distribution of the centres of pigmentation. In this article the conclusion is reached that there is usually in the case of mammals a symmetrical (metameric) arrangement of the centres of pigmentation in five pairs of centres.

G. B

338. Value of Methods of Milk Testing.

LAPLAUD, M., DE LA FREGONNIÈRE and DUFFAU. De la valeur des méthodes de contrôle laitier. *Revue de Zootechnie, la revue des éleveurs*, Year 3, No. 10, pp. 239-247. Paris, 1924.

The "Commission Technique d'Organisation et de Contrôle du Centre National d'Expérimentation Zootechnique des Vaulx-de-Cernay" carried out experiments on the testing of milk to ascertain to what extent the results agree of tests made daily, weekly, fortnightly, once every three weeks, and monthly.

The test was made on 10 cows of pure Normandy breed from the same farm, over a complete lactation period, of average yield of milk, and kept under the same conditions, i. e. milked twice a day, fed in the same way and looked after by two equally capable dairymen.

To avoid all possibilities of variation all animals of very high milk yield were excluded, as were the final periods of lactations. The number of samples tested was 5256; the quantity of milk, the fat content, acidity and density were determined.

During the test the cows received in winter the following ration: beets and fine straw 10 kg.; oat-straw 7 kg.; hay 5 kg.; concentrated feeds (bran, ground-nut cake and maize gluten) 2-3.5 kg., and in summer, from April to September, they were pastured, with the addition in July, August and September of 16 kg. of fodder peas per day.

The lactation period averaged 263 days, varying from 206 to 363 days; the yield was slightly over 10 kg. per cow per day during the milking period and 7.3 kg. per head per day throughout the year.

The results were recorded month by month of each day's tests, then lactation by lactation; the arithmetical averages of each lactation gave results which were compared with the arithmetic averages of the samples taken each week, fortnight, three weeks and month.

The extent of variation was thus ascertained for tests made weekly, fortnightly, every three weks and monthly, as compared with the daily tests.

The variation in the averages for the evening is generally greater

than that for the morning. The corresponding variation for the day is nearly always less than the smallest variations either in the morning or the evening.

Quantity of milk. — The variations as compared with the daily tests are not proportionally higher with the lengthening of the period, taking each cow separately.

The maximum variations observed were : 3.53 % for the weekly tests ; 5.81 % for the fortnightly ; 8.1 % for the 3-weekly (4 times in 10) ; and 9.95 % for the monthly tests (6 times in 10).

The variations as compared with the daily tests are on the contrary proportionally greater as the period increases, taking the average results for the 10 cows. They are : 1.04 %, 1.48, 2.08 and 2.68 %, respectively, for the weekly, two-weekly, three-weekly and monthly tests.

There are two causes of variation which are as important as the periodicity of the tests : incomplete milking and error in weight. The former depends on the conscientiousness and skill of the milker, the latter is practically 1-2 % with the instruments usually employed. There is no compensation, but coexistence of errors, and consequently the daily testing of quantity may be no more exact than the periodic test.

Fat content. — The variations as compared with the daily tests are not proportionally greater as the period lengthens, taking the average results for the 10 cows.

Maximum variations observed in the case of :

Test made	Cows taken separately	Average result for the 10 cows
Weekly	4.3 %	1.[illegible] %
Fortnightly	6.64 %	1.87 %
Every 3 weeks	11.7 % (3 times in 10)	2.90 %
Monthly	9.9 % (6 times in 10)	[illegible].77 %

The variations due to incomplete milking and errors in weight may be considerable. The error in reading by the controller may be 2.5 % daily for the fat content.

Acidity. — The variations for the 10 cows, as compared with the daily test are proportionally higher as the period increases. The maximum variation is that of the monthly control, which is above 2 %.

Density. — The variations for the 10 cows, as compared with the daily test, are proportionally greater as the period increases.

The maximum variation is that of the monthly control, which is below 1 %.

P. D.

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Special.

339. **The Horse in Indo-China.**

TRICARD, A. *Bulletin économique de l'Indochine*, Year XXVII, No. 166, III 1924, pp. 200-230, 6 plates. (Reprint under separate cover).

The native horse. — The Indo-Chinese breed of horse at one time included a variety of types possessing a number of common characteristics, as although the area of French Indo-China is larger than the area of France by one-fourth, these different types, belonging to parts of the country lying at considerable distances from each other, have never displayed any such differentiation as that which separates, e. g. the 'percheron' from the 'tarbais' or the Norman breed from that of the Landes.

These types half a century ago, constituted pure, although closely allied, breeds known as the Cambodia, the South Annam, and the Tonkin.

At the present day the purebred horses have almost disappeared, for apart from the crosses between neighbouring breeds, the foreign elements, which were introduced through the cavalry horses of the army of conquest, and afterwards with the object of improving the breed in Indo-China, have brought about modifications of the original characteristics. Among such elements were Arabs, Bretons, Polish horses, Tarbais, Tartar, Landes and Australian breeds.

It is however possible to give the outline characteristics of the Indo-Chinese horse as for a single type, as follows:

Horse of small height (1m.15 to 1m.28), proportioned generally on small lines. The strong head is supported on a short thick neck, with a bushy mane; the withers are often thick and ill defined; the back is wide, usually short and rarely saddle shaped; the loins well attached but sometimes concave as a result of too early working; the croup is inclined to sag; the chest is wide and fairly deep. The barrel is round, the rump and shoulder muscular; the legs, which are often rather short, are strong and the extremities delicate and sound; blemishes are exceptional, but the hind legs are usually crooked and the hocks are close together.

To sum up, the type appears apart from the height to be a composite of two French types: the Breton type in the forequarters and the ordinary mare of the South of France in the hindquarters.

The coat is usually light, either grey or dun, but there is considerable variety owing to the number of crossings. To-day the grey coat is less often seen.

The Indo-Chinese horse possesses excellent qualities due to his sanguine temperament and thickset conformation. He is full of energy, works hard, resists fatigue well and is at the same time hardy and docile. His agility and surefootedness are remarkable and are comparable to those of the mule or the ass.

As he is a steady worker, he is eminently adapted for hard pack-saddle work on the mountain paths. Going at an even pace with relatively heavy loads of 50 or 60 kilogrammes, he can accomplish long

stages by difficult roads, narrow, slippery and with constant obstacles which he scrambles over without attempting to leap.

The horse of the country is usually good-tempered but sometimes obstinate and capricious. His feet constitute an undeniably strong point, as the hoofs practically resist all wear and tear.

His weakest point, as a sadle horse for Europeans, lies in the height and general conformation : his action is not easy, the difficulty being increased by the high centre of gravity of the whole mass of horse and rider, the seat is insecure and the saddle is apt to shift from not fitting well over the rounded shape of the flank.

For his build the Indo-Chinese horse is remarkable for the rapidity of his paces. At his usual walking pace he goes 7 km. an hour ; he is besides trained by the native from his earliest years to amble, which is with him quicker than trotting. It is very exceptional for him to be galloped.

Some degeneracy in the Indo-Chinese horse is noticeable and strong hardy horses of 1.25 metres to 1.30 in height have become a rare exception. The decline in numbers already remarked in the native breed does not apply, strictly speaking, to the part of the country where breeding goes on, but to the centres where there is a demand for good horses for ordinary use. As a matter of fact, production is nearly stationary, while the quality has deteriorated and the demand has increased. There are evident signs of a want of equilibrium between demand and supply, and at the same time degeneracy in the breed. The author is making a study of the causes of this state of affairs.

Improvement of breed. — In regard to the improvement of the Annamite horse, there was a period of careful breeding up to 1900 ; from that date an experiment was tried of which a very widespread application should have been made from 1906, by the importing of 450 mares, though this importation should have been carried on for a longer period ; a period of inactivity followed, the experiments being however continued in the Annam breeding stations, and since 1920 there has been a serious resumption of activities.

The production of the half-blood is essential : to arrive at the three-quarter breed the half breed is required ; but the obtaining of the half breed is not to be considered as an end in itself, it is merely an intermediate though essential step. It must not therefore be generalised. It is the three-quarter breed that must be produced and must interbreed in order to fix the type of the true improved Annamite breed.

The Breed Improvement Council in Indo-China met in October 1919. It continued work into 1920, and since February a report has been issued in which the resolutions of the Council were thus formulated :

1) Import of stallions of the breed known as 'Mogods', from the Regency of Tunisia ;

2) New regulations for the breeding premiums, which are to be mainly awarded on results, also formation of the Stud-book ;

3) Establishment of intermediate stations for Army Remounts ;

4) Compulsory castration of army horses, and if possible in the country districts castration of the horses not required for breeding;

5) Annual Agricultural Show.

The author discusses the following: castration, stallions, premiums, transition depots (where colts are kept which have been bought very young with the object of eventually being used as Army remounts), shows, race meetings.

The following are his conclusions:

Is the horse tending more and more to disappear in Indo-China with the advent of the motor-car? More than one provincial chief and the higher branches of commerce seem to have lost interest in the horse. This attitude of mind must not be allowed to continue. Races, premiums for breeding establishment of transition depots are factors of first importance in this sense.

The high cost of labour will also, sooner or later, make it necessary to employ horses for the drawing of carts and drays to which now, as may be seen every day even in the towns, men, women and children are harnessed.

The rickshaws will disappear more or less quickly as a result of the increasing cost of labour and also as education becomes more diffused. They will be replaced by the horse, as may already be seen in the Philippines, where the town of Manilla has 6 000 carriages with two seats without taking into account the 10 000 motor cars in use.

In addition in the event of mobilisation of the forces, Indo-China may have to recruit the necessary horses on the spot.

The efforts made shall prove successful. It is not as if it were a question of introducing a new animal into the country, and difficulties of climate, problems of acclimatisation or uncertainties as to food had to be met, it is simply a question of renewing the breed of horses, of re-establishing and even increasing the production. Neither high prices nor the success of the motor-car enter into the question. The two methods of locomotion can prosper side by side in their respective spheres. What is wanted is agreement as to the outlook and the maintenance of the financial credits required by the programme adopted: since 1920 the central Government in the first place, and afterwards the local Government of each district, have set aside each year larger credit and have shewn themselves very favourably disposed to the adoption of the measures proposed, including that of a transition depot, which is the real key stone to any scheme of horse breeding. The future may be regarded with confidence. (Indo-China Corr).

[illegible] - The Decline in Breeding of Light Horses in Austria.

WERTHNER, (Adviser on Horse-Breeding to the Government of Lower Austria). Die Hengstenkörung in Niederösterreich im Jahre [illegible]. *Die Landwirtschaft*, Part 1, 15 January [illegible], pp. 4. Vienna, [illegible].

In consequence of the reduced demand for light horses, due to the increase in the number of motorcars and the disbanding of some of the

cavalry regiments, there has been a falling off in the breeding of horses of this type, while the breeding of heavy horses has increased. While the number of the government stallions of the light horse breeds was reduced in the course of the year 1924 from 49 to 39, only 25 mares on an average were served. The number of the heavy horse stallions rose from 75 to 78, serving on an average 34 mares. Out of the 79 private stallions 28 belonged to the heavy horse breeds, 23 were trotting horses, 12 were English thoroughbreds and 16 belonged to the different light horse breeds. On an average only 14 mares were served by these stallions. A small addition was made to the number of the government stallions of the Hoflinger type, a small light breed, which enjoys considerable popularity.

H. K.

341. Effect of Feeding Cabbage and Potatoes on Flavour and Odour of Milk.

BABCOCK, C. J. (Assistant Market Milk Specialist, Bureau of Dairying). *United States Deartment of Agriculture, Deparlment Bulletin* No. 1297, pp. 12, ill. 10, graphs. 4. Washigton, D. C., 1924.

Results of tests made by the Bureau of Dairying at the Experimental Farm at Beltsville, Md., in order to determine : (*a*) If cabbage and potato feeds affect the flavour and odour of milk ; — (*b*) how to distribute these feeds and treat the milk in order if possible to reduce the effect on the milk to a minimum.

In the tests the author used 6 Holstein and 10 Jersey cows.

The animals received as a maintenance ration, in quantities varying according to the quantity of milk produced, the following mixture : maize gluten 100 kg., bran 100 kg., oats 100 kg., linseed cake 50 kg., cotton cake 50 kg., and in addition, as much as the animals would take of lucern hay.

The cows were divided into groups of 4 :

1st group : maintenance ration + hay (check).

2nd group : maintenance ration + hay + 15 lb. of cabbage or potatoes fed 1 hour before milking.

3rd group : maintenance ration + hay + 30 lb. of cabbage or potatoes fed 1 hour before milking.

4th group : the same as the 3rd group fed immediately after milking.

Samples of milk were taken from each cow during milking; the milk was cooled but not aerated.

In order to judge of the effect of aeration on the flavour and odour of the milk produced by a cow fed as above, samples were also taken of the milk after it had been allowed to run over a surface refrigerator.

These tests gave the following results :

The consumption of 14.3 lb. of cabbage 1 hour before milking causes a disagreeable odour and flavour in the milk. If the quantity consumed is increased from 14.3 to 24 lb. on an average, the odour and flavour of the milk are considerably intensified.

If the animal consumes 25 lb. of cabbage immediately after milking, the milk has a disagreeable odour and flavour.

Suitable aeration considerably decreases the odour and flavour imparted to the milk by the cabbages and suffices to eliminate a slight odour and flavour developed before aeration.

The flavour and odour caused by cabbages are slightly less pronounced in cream than in milk.

A consumption of 14.8 lbs. of potatoes 1 hour before milking causes a very slight abnormal odour and flavour, rarely noticeable in the case of most animals. If the quantity be increased from 14.8 to 29.8 lb. the flavour and odour of the milk are not accentuated; 28.7 lb. of potatoes immediately after milking has no effect on the flavour and odour of the milk. P. D.

342. **Influence of Diet and Sunlight on the Vitamine Content of Milk.**

LUCE, E. M. (Department of Experimental Pathology, Lister Institute). The Influence of Diet and Sunlight upon the Growth-promoting and Anti-rachitic Properties of the Milk afforded by a Cow. *The Biochemical Journal*, Vol. XVIII, Nos. 3-4, pp. 716-739, 3 tables, bibliography. Cambridge, 1924.

The milk from the same cow is subject to remarkable variations as regards its anti-rachitic and growth-promoting properties.

The cow's diet is probably the main factor in determining the growth-producing value. When the cow has a diet of green fodder the milk possesses a growth-promoting value much larger than if fed on dry feed, deficient in fat-soluble vitamines. These results are the same whether the cow is kept in sunlight or in a dark cowshed and it would therefore seem that no conclusions as to the action or otherwise of light can be drawn from these experiments.

The anti-rachitic properties depend on the diet of the cow, and probably on the degree of illumination to which it is exposed.

The milk of cows, kept in open pasture, has a marked and high anti-rachitic value, while if the animal is kept in a dark cowshed, it yields a milk much inferior from the point of view of its effect on rachitic conditions.

It is not improbable that the seasonal incidence of rickets among children has a definite relation to these facts, in so far as the milk would have a higher anti-rachitic value in summer than in winter. A. F.

343. **Influence of Epizootic Abortion on the Milk and Butter Production of Normandy Cows.**

LEROY, A. and RECOURA, M. G. Influence de l'avortement épizootique sur la production laitière et beurre des vaches normandes. *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. X, No. 35, pp. 109-121. Paris, 1924.

During an epidemic of infectious abortion the authors had the opportunity of investigating the irregularities in the milk and butter production caused by premature calving of a Normandy breed of cows subjected to

milk testing. The data obtained from tests carried out on 24 animals were examined, and the quantities of milk and butter yielded by each in 10 months were estimated after normal calving on the one hand, and abortion on the other.

The lactation estimates were corrected to make allowance for the influence of the date of calving and the age of the cows. After a normal calving the average yield for each of the 24 cows rose to 3 576 kg. of milk and 171.2 kg. of butter ; after an abortion, on the contrary, the corresponding average yield was 3 235 kg. of milk and 117.6 kg. of butter.

While the average fat content of the milk was 4.2 % in the former case, it rose to 4.4 % for the 24 abortion lactations.

It seems therefore that after a premature calving due to infection, the cows yield a smaller quantity of milk with a slightly higher fat content.

The authors then endeavoured to ascertain what relation there is between normal yields and those after abortion, they found that there is little or no relation between the period of gestation and the deficiency of milk production.

The following is a summary of the conclusions drawn :

1) Epizootic abortion decreases by about 33 % the quantities of milk and butter that can be obtained from a cow during a period of normal lactation.

2) The milk yields after abortion, for a period of 10 months, appear to be in close relation to those found after a normal calving.

3) The duration of the abortive gestation only very slightly affect the decreases in milk and butter production during lactation after premature calving.

4) The effects of abortion can, to a certain extent, be likened to those of a previous lactation continued up to calving, without apparent mammary rest.

It is perhaps because it causes premature lactation, without previous mammary rest, that abortion produces the above-mentioned effects.

P. D.

344. **The Lagrenée Sheep Breed : a successful Cross in Tunis.**

GINIEIS. La race ovine Lagrenée ; un croisement heureux pour la Tunisie. *Revue de zootechnie, la revue des éleveurs*. Year 3, No. 10, pp. 286-283. tables 6. Paris, 1924.

With a view to the production of an early maturing, well-formed breed, with good quality meat and strong wool, of an improved type, and at the same time as resistent to " Hamra " (a solar erythema caused by the action of the sun's rays on animals which have eaten a variety of St. John's wort, called " hamra " by the Arabs) as the native breed, Mme. LAGRENÉE crossed the Algerian ewe with the Solognot ram, both having a white fleece and red extremities. The introduction of a French breed was not possible, for, owing to their depigmentation, the various French breeds are attacked by hamra. The native Barbary breed with a large tail presented many drawbacks : poorness of meat, hypertrophy of the

caudal appendix necessitating the intervention of the shepherd during service and causing numerous cases of sterility due to the shepherd's negligence

The Algerian Barbery with red extremities " and the " Solognot " were then crossed. The latter is a small sheep, slender and long in line, with excellent meat, vigorous, hardy, requiring little attention, and very resistent to aqueous cachexy, hornless, with a white fleece having red extremities and with the skin of the whole body pigmented. The hair on the head and limbs is fine, glossy and bright red. The brown pigmentation of the skin renders it almost immune from the attacks of " hamra ".

The " Algerian Barbery with red extremities " is small and thick-set, with well-developed horns and white fleece ; the head and limbs are red, being covered with rough, dull, coarse, pale-red hair. The tail is thin, and the milk capacity developed.

On the whole, the Solognot-Barbery sheep form a homogeneous and well-defined group. The animals are about 65 cm. high at the withers and weigh on an average 50 kg. ; they generally have no horns ; the hair underneath and the skin are completely pigmented or pied-red ; the fleece is white or reddish-white and the extremities are bright red in colour. The fleece is not full, as it stops short behind the nape of the neck, along the cervical knot at the juncture of the neck and shoulders and at the upper third of the fore and hind legs ; it sometimes stops at the neck, at the stiflejoint and at the line of the rump, and in exceptional cases covers the throat and the larger part of the belly. The fleece is loose, not thick, with pointed tufts and dry, uneven, coarse wool ; the weight found was as follows :

In 1919,	1.358	kg.	per	fleece	at the	age	of	42	months.
1920,	1.240	»	»	»	»	»	»	5	years.
1921,	1.140	»	»	»	»	»	»	6	»
1922,	1.025	»	»	»	»	»	»	7	»

The animals are quiet, hardy, agile, good walkers and easy to rear ; their meat is of good flavour and owing to the pigmentation being spread all over the body, they are still more immune to the attacks of " hamra " than the native sheep of which only the extremities are coloured

The females are comparatively early-maturing. P. D.

345. **Goat-Keeping in Malaga.**

EGANA, S. C. (Veterinary Inspector for the Province of Malaga). *Revue de Zootechnie, la revue des éleveurs*, Year 3, No. 8, pp. [illegible]. Paris, [illegible].

The Malaga or coast goat is small (averaging 65-70 cm.) ; the he-goats are larger, but do not exceed 75 cm. The length of the body from the breast to the pubis is 70-80 cm. The head is small, broad, the profile straight with a tendancy to convexity. The horns are placed high, straight up and curving backwards, forming a perfect arc, the ears large and pointed and inserted perpendicularly to the cranium. This goat has a long

PLATE XLVII.

FIG. 97. — Types of Malaga goats.

lock, beginning at the "chignon" and falling over the forehead, and a very short beard, which is sometimes absent in the she-goats.

The shape of the trunk is a parallelogram, the vertebral column is straight, slightly saddle-backed and more so in the females than in the males.

The typical form of the udder is considered to be globular or pouch-like ; the juncture of the texts shows great variation ; that most preferred is the union at the base of the udder and perpendicular to the ground Breeders look for an udder rich in glandular tissue, without any obstructive ligament extending the udder and increasing its volume without increasing the yield.

The Malaga goat has long hair over the whole of the breadth of the vertebral column and on the thighs ; over the rest of the body the hair is soft and short. The ends of the long hairs are generally lighter in colour than the rest of the coat. These characteristics regarding covering have undergone more or less extensive alteration in consequence of cross-breeding. The coat is light and of varied tones ; some animals are black.

A Malaga she-goat yields 400-500 litres of milk ; she generally bears two kids (in 90 to 95 % of cases). At the time of giving birth the yield reaches 3-4 litres of milk per day ; with good milkers, well fed and reared scientifically, this yield is maintained for 3-4 months ; the yield then falls to 1-1.5 litres, but remains at the latter figure for a long time.

On small farms the goats are not well fed nor of good type. On giving birth they generally yield 3 litres of milk ; after 1 or 2 months the yield falls to 1 litre per day.

To ensure a continued yield by the herd, the breeding time is divided into 3 periods :

(*a*) the early kids at the end of summer or in autumn, the lactation period is short ; (*b*) the "nursing" (kids) in December or January, the longest period of lactation ; (*c*) the "late" kids, at the end of spring or beginning of summer ; average lactation period.

The method of milking is closely related to yield ; the Malaga goat-keepers leave a certain quantity of milk in the udder and do not continue milking regularly but with frequent interruptions. They have observed that a goat which is emptied in milking becomes quickly exhausted and produces less.

The Malaga goat is bred for its milk. The goat-keeper or "Churretro" has 20 or 30 she-goats and takes them to the town ; the large owners follow the same system except that milking is done at the farm and the milk is carried to the town.

Feeding is mixed ; the goats eat what they can find out of doors, and on returning to the stable receive a ration of broad beans, a feed which it has been impossible to replace by maize, carobs, etc. If there is no pasture available the goats are led along the roads and feed on olive and eucalyptus branches, lucerne, cactus, green maize tops and agaves, and afterwards receive their ration of broad beans. The agave is the best of these feeds. Only the ration of broad beans is measured, the rest are distributed approximately. Many keepers crush the broad beans, which is

more economical ; about 1-2 kgs. of beans per head per day are fed. Feeds being cheap and the milk fetching a good price, profits are large, especially for the keeper who sells his produce direct.

Keepers are not in the habit of letting their goats breed, for the rearing of the kids is very troublesome. The best animals produce for 4-6 years and are finally sent to the butcher..

The meat is generally sold at 2.50 to 3 fr. per kg. The skin is greatly valued for making the leather receptacles for containing oil. The open skins fetch 3-4 pesetas each (1 peseta = 1 fr. at par), whole skins 6-7 pesetas and buckskins even more.

The *Velez* fair is the most important market ; a young goat in kid is valued at 75-100 pesetas ; one-year olds 15-17 pesetas, and choice animals more. In judging a she-goat, the keepers only attach importance to the udder, especially, to its feel ; it must not be " pasty " and should be of a fine pink colour, with prominent veins. P. D.

346. **The Mineral Metabolism of the Growing Pig.**

RICHARDS, M. B., GODDEN, W., and HUSBAND, A. D. (Rowett Research Institute, Aberdeen). The Influence of Variations in the Sodium-potassium Ratio on the Nitrogen and Mineral Metabolism of the Growing Pig. *The Biochemical Journal*, Vol. XVIII, Nos. 3-4, pp. 650-660, 3 figs., bibliography. Cambridge, 1924.

The object of these researches is to ascertain the effect of additions to the cereal rations of sodium chloride which, according to some authorities, increases the rate of growth. In reality the effect is, like that of sodium citrate, to promote the assimilation and retention of nitrogen, calcium and phosphorus.

Increased quantities of sodium salts in the feed stimulate the excretion of potassium in the urine, an increase in this respect being always considerable, even after a fortnight of regular administration of the salts.

The excessive excretion of potassium in the urine is more or less counterbalanced by the diminution in the faecal excretion. There is accordingly only a slight deviation from the normal, even during the period of abnormal urinary excretion. The result of these observations is to show that in investigations of this kind it is essential to undertake analyses of the faeces and urine at one and the same time, if serious error is to be avoided. A. F.

Poultry.

347. **The Shape and Weight of Eggs in Relation to the Sex of Chicks.**

JULL, M. A. and QUINN, J. P. Bureau of Animal Industry, U. S. Dept. of Agriculture). *Journal of Agricultural Research*, Vol. XXIX, No. 4, pp. 195-201, 8 plates. Washington, D. C., 1924 (received in 1925).

In order to determine the relation between the form of the egg and the sex of the chick, the length and maximum breadth of each of 990

eggs laid by 24 Barred Plymouth Rock pullets between the middle of February and the end of April, were measured at the time of laying. The sex of the chicks was determined by dissection at hatching time.

Of the 990 eggs, 512 produced males and 478 produced females, the mean length of the eggs producing males is 55.31 ± 0.06 mm. and the mean length of the eggs producing females is 55.42 ± 0.07 mm., that is, a mean difference between the two sexes of 0.11 ± 0.09, or a variation, which is both absolutely and relatively, very slight. If the production of each pullet is considered separately, it is observed that among 13 individuals the mean length of eggs producing males is greater than the mean length of eggs producing females, and that with 11 other individuals the reverse is the case.

The shape of the eggs was determined by the length-breadth index obtained by dividing one hundred times the breadth by the length. A long and narrow egg has a low index, while a short and broad egg has a high index. The mean index of eggs producing males was 75.17 ± 0.09 and that of eggs producing females is 75.09 ± 0.10, or a mean difference of 0.08 ± 0.13.

For the study of egg weight in relation to the sex of chicks eggs from two different sources were examined: 1. eggs obtained from 153 Barred Plymouth Rock females mated to Rhode Island Red males; 2. eggs from 58 Rhode Island Red females mated to Rhode Island Red males.

The weights of 418 and 226 eggs in the former and latter cases respectively or 644 eggs in all were considered, the eggs being weighed daily as laid.

Of the 418 eggs from the Barred Plymouth Rock females, 347 hatched and 71 died in shell at hatching-time.

Out of the 347 eggs hatched there were 190 males and 157 females. The mean weight of the eggs producing males was 58.64 ± 0.19 gm. and the mean weight of those producing females was 58.53 ± 0.21 gm., a mean difference of 0.11 ± 0.28 gm.

Out of the 71 eggs whose chicks died in shell at hatching time, 30 males and 41 females were identified.

The mean weight of the eggs producing males was 57.56 ± 0.44 gm., and that of the eggs producing females was 57.82 ± 0.32 gm., i. e. a, mean difference of 0.26 ± 0.61.

Taking the results for all the 418 eggs, the mean weight of the eggs producing males is 58.49 ± 0.17 gm. and the mean weight of the eggs producing females is 58.45 ± 0.19 gm., a mean difference of 0.04 ± 0.25

Out of the 226 eggs from the second source, the mean weight of the eggs producing males is 58.06 ± 0.26 gm. and the mean weight of the eggs producing females is 57.29 ± 0.27 gm., or a difference of 0.77 ± 0.37.

Taking all the 644 eggs into consideration the following figures are obtained: mean weight of eggs producing males, 58.24 ± 0.14 gm.; mean weight of eggs producing females, 58.01 ± 0.16 gm.

The mean difference is thus 0.23 ± 0.21 gm.

In conclusion it may be stated:

There is no correlation between the absolute length of an egg and the sex of the chick hatched from it.

There is no correlation between the shape of an egg and the sex of the chick hatched from it.

There is no correlation between the weight of an egg and the sex of the chick hatched from it. P. D.

348. Laying Competition at Klosterneuburg, Austria.

WIENINGER Councillor, Technical Adviser on Poultry-breeding to the Federal Ministry of Agriculture and Forestry *Bericht über die ersten Leistungsprüfungen der Hühner am Wettlegehof in Klosterneuburg im ersten Legejahre 1923*-1924. 31 pages, 11 illustrations. Vienna, 1924.

A poultry farm with special arrangements for laying competitions (*Wettlegehof*) was established in 1923 at Klosterneuburg near Vienna, on the model of the hen-testing stations of a number of other countries, for the purpose of ascertaining the laying capacity of hens coming from poultry breeding stations, as well as to relieve the majority of breeders of the trouble of testing their own hens and to ensure their obtaining the best eggs for setting.

The scheme is under the strictest State inspection, which covers the number and size of the eggs, their colour, the consumption of feed with the corresponding return, broodiness, moulting, etc.

The tests extend over two years and are applied to whole pens, each consisting of a cock, six hens and a reserve. The feeding and general care is naturally identical for all the birds. Each of the twenty groups on which the tests are being carried out is placed in an isolated wooden fowl-house, provided with trap-nests in three separable parts, an automatic feeder and a drinking trough. Alongside of each fowl-house, which is 2.50 metres long, 1.70 metres deep and 1.50 metres high at the back and 2.0 in front, a small covered pen is attached, which is open towards the south and east and has a run of 70 square metres.

The report for the first year states that the poultry very quickly became used to their new conditions and to the automatic feeder and that the hens lay well even in a hard winter and in cold nesting places, if they are hardened and have the opportunity of obtaining the warmth they need in the form of food from the automatic feeder. It appears too that the size of the run is not of so much importance, provided that the hens can find green stuff or insects on it; on the other hand a small covered shelter is indispensable for the days when the weather prevents fowls remaining long in the open.

The results of the first year showed that no breed is to be singled out as unconditionally the best laying breed and that good and bad characteristics appear sporadically in different individuals of the same breed and are even separately inherited. In every pen there were very good, good and bad layers, and corroboration of this lies in the fact that the rivalry between poultry breeders in Austria is still in its early stage.

It was noticeable that the influence of the weather on the laying

capacity was nor marked, a fact which is attributable to the provision of a permanent shelter and to the automatic feeder ; and further that broodiness interferes more than moulting with the laying.

The winning breed of the season 1923-24 was a family of white Leghorns belonging to the Pfannhauser poultry farm at Mitterndorf on the Tischa, which produced 886 eggs. A pen from Sulmtal came second with 861 eggs and a pen of Saxony fowls with 790 third. A pen of Plymouths with 300 eggs stood twentieth, while another family of the same breed came eighth, a good illustration of the diversity among individuals of the same breed.

The performance of each single hen is naturally also tested and furnishes additional evidence that the rate of egg-production is an entirely individual characteristic of the bird, and often varies to a quite extraordinary extent within any one pen.

Each pen was kept under test for a year and then returned to the owner who can then resume breeding.

The mixed feed given in the feeder consists of 10 grammes of dried yeast, 10 grammes of meat-meal, 5 of fish-meal, 30 grammes of wheat-bran, 20 of barley middlings and 4 grammes of charcoal per hen and per day. In addition they are fed rations of 10 grammes of maize, 10 of wheat and 20 of oats, half being given in the morning and half in the evening. The daily consumption on an average is 66.2 grammes from the automatic feeder and 50 grammes of the cornfeed. Besides, the hens daily pecked over about 48.7 grammes of green feed, turnip tops or artichoke.

The feed used was chemically analysed each month. The average content in nutritive material was : 17.05 % albumen, 3.74 % fats, 52.77 % carbohydrates. The nutriment ratio was 1 : 3.6, the number of calories 328, the starch value 77.

The cost of the feed per egg was estimated to be on an average 1438 krone. In the case of individual birds it fluctuated between 1037 and 3328 krone and the usual market price in the middle of the period was 1930 krone.

The aggregate weight of the eggs of all the hens was 13.6 % of the weight of the feed taken. The White Wyandotes could however produce eggs of a weight of 17.4 % of the feed, while the worst pen only accounted for 7.3 %.

The first egg was usually laid on the 286th day. A hen from Alsteirer however laid her first egg on the 116th day.

The first egg usually weighed 2.6 % of the weight of the hen on the day of laying. The average weight of an egg was 57 grammes. Variations occurred in the different pens, taking the whole year, of from 52 to 61 grammes. The white Leghorns that gained the first place produced eggs of an average weight of 56 grammes.

The general interest roused by this establishment is very marked. The monthly reports are regularly published in a number of journals, and the President of the Federation, Dr. Michael Hainisch, was present at the formal opening.

H. K.

[348]

FARM ENGINEERING.

Methods of Cultivation and Machines.

349. New Methods of Cultivating Dry Soils in Spain.

I. — QUINTANILLA G., Director of the "Estación Agronómica Central" and of the "Estación de Agricultura General" at Alcalá de Henares (Madrid): Alfalfa in Beds. Nuevos cultivos de secano en España. *El Progreso Agrícola y Pecuario*, Year XXX, No. 1,340, pp. 249-252, figs 4. Madrid, 1924.

II. — BENAIGES DE ARIS C. (Ing. Agr., Professor at the Escuela Especial de Ingenieros Agrónomos): The Double-Row System. *Boletín mensual de Olivicultura y elaboración moderna del Aceite de oliva*, No. 70, pp. 466-470. Figs. 3. Tortosa (Tarragona), 1924.

III. — *Idem, Idem.*: The Double-Row System and the Application to Olive Plantations. *Idem*, No. 71, pp. 471-476. Figs. 3. *Idem.*

I. — The author had delayed publishing the results of his investigations until they had been confirmed by experiments carried out for several years. In 1917, at the Agricultural Station at Alcalá de Henares, he sowed two plots of 500 sq. m., with alfalfa seed from Aragon (Spain), perfectly hulled and of high germinative power, in double beds each 30 cm. wide, each pair being separed in one plot by a distance of 80 cm. (Plate XLVIII, fig. 98), and in the other by a distance of 120 cm. (Plate XLIX, fig. 99). In the spaces between the beds the soil was tilled by a small one-horse plough during the different stages of growth, in order to preserve the soil moisture. This was the first trial of the sort made in Spain, and the unfavourable conditions led the author to expect that it would be a failure. The soil in which the trial was made is rich in phosphorus and potash, poor in lime in the top layer, of average content in the middle and rich in the lower layer, and all three layers were poor in nitrogen, this scarcity increasing with the depth. The average annual rainfall registered at the Station Observatory is 367.5 mm., this figure being obtained by finding the average precipitations for the years 1917 to 1923, during which the tests were made. The results are given in the following table:

From the above data and other data relating to the price of labour, fertilisers, etc., the author gives a detailed account of the expenditure and profit accruing from the cultivation of alfalfa, with the result that an annual profit is shown per ha. of 354.79 pesetas in the case of cultivation in beds separated by a distance of 0.80 m. and of 343.60 for beds separated by a distance of 1.20 m. Although the difference is very small these results are of economic importance. From the annual precipitations utilised by the alfalfa for growth, it is deduced that each unit of dry matter produced corresponds to 1,591.70 units of water. Bearing in mind the nature of the soil, transpiration, evaporation, etc., it follows that, to produce one unit of dry matter the alfalfa will require $^{5}/_{7}$ of 1591 or 1161 units.

PLATE XLVIII.

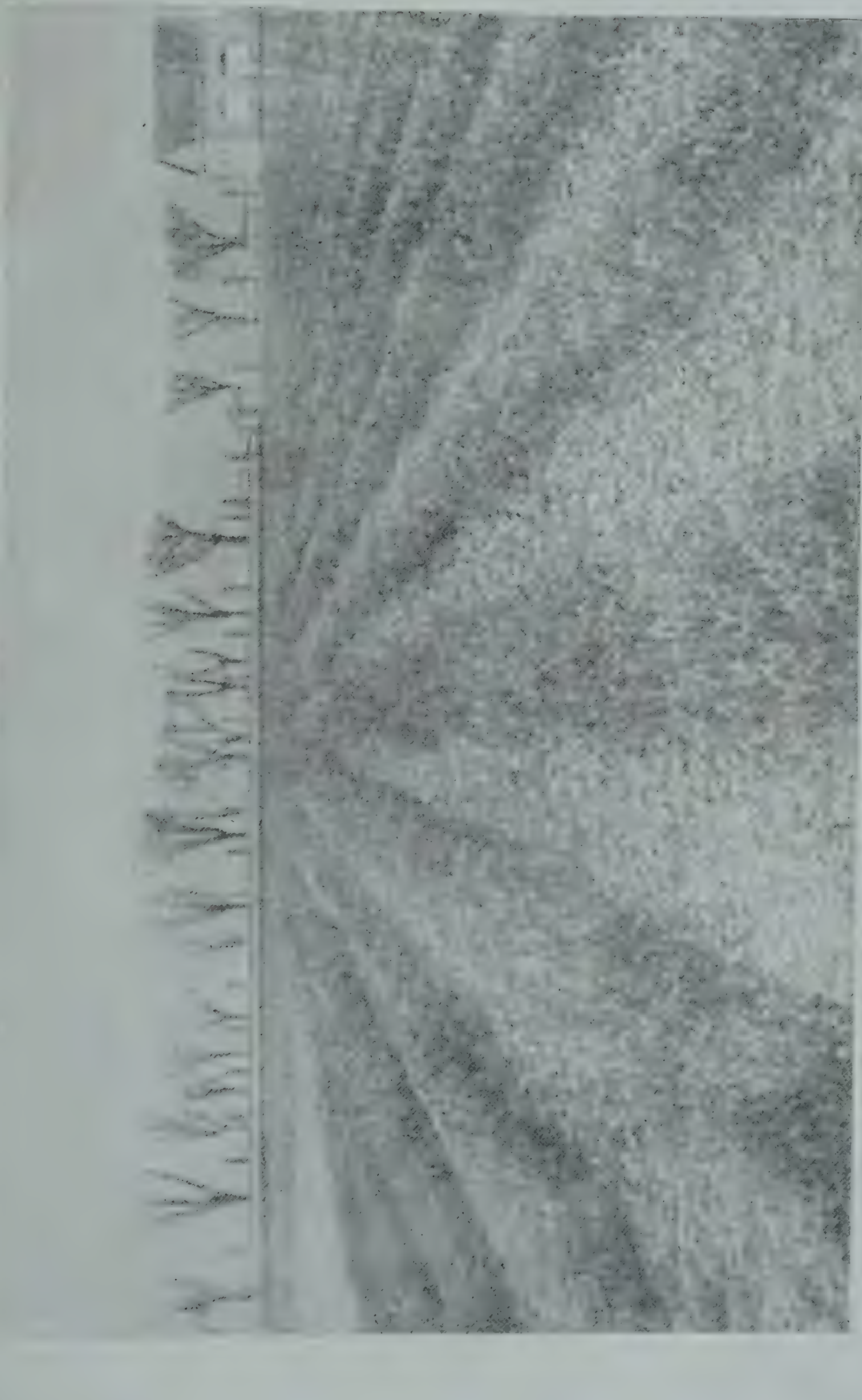

FIG. 98. — Alfalfa cultivated on dry soil, at the General Agricultural Station at Alcalá de Henares (Madrid). Beds of 0.30 **m.** in width. Distance between beds 0.80 m.

FIG. 99. — Alfalfa cultivated on dry soil, at the General Agricultural Station at Alcalá de Henares (Madrid).

Beds of 0.30 m. in width. Distance between beds 1.20 m

FIG. 100. — Crop of wheat obtained on dry soil, after leguminous crop, without fall[illegible] by the "double-row system."

The extraordinary development of the ears and high grain yield show the ad[illegible] of the system, wich is based on a suitable crop rotation, deep cultivati[illegible] quent and thorough surface tillage of the beds between the double rows. In [illegible] growth, the passages of 42 cm. in width were not closed in, thus allowing during [illegible] period, the use of the small cultivator and the effective action [illegible]

FIG. 101. — The "double-row system" applied to cereal crops.

The ploughing, breaking down and cleaning of the passages of 40 to 50 cm. wide left between the beds or double rows sown, and the light earthing-up of the plants, increases the yield and preserves soil humidity.

The ventilation of the top layer of the soil stimulates nitrification, oxidisation, the formation of soil substances and the liberation of the soil reserves.

FIG. 102. — Single-furrow plough for the "double-row system" small pattern, drawn by one small animal — fitted with extensible knives for cutting weeds between the plots, hand-weeding being thus dispensed with. Fitted with other appliances for breaking down the soil and earthing up the plants.

According to the nature of the soil, from 1 to 1 ½ hectares can be ploughed in one day, with only one small draught animal and a boy driver.

Results obtained by "Bed" Cultivation 1917-1923.

Year	No. of cuttings	Yield of dry alfalfa per ha.	
		Distance 0.80 m.	Distance 1.20 m.
		Kg.	Kg.
1917	1	460	420
1918	2	1,040	1,220
1919	3	3,480	3,280
1920	4	4,220	3,900
1921	4	3,700	3,580
1922	5	3,050	3,070
1923	3	2,400	2,400
	Average yield	2,621.430	2,554.85

The yield of dry alfalfa, with an average rainfall of 377.5 mm., in the open field, the soil depth of which varies from 70 cm. and upwards, will vary between the limits of 2,621 and 3,933 kg., *on condition that it be sown in beds and that the intervening spaces be constantly cultivated after the rains, and on the appearance of weeds.*

The author then states the advantages which would follow from a general adoption of this system by stock-breeders and farmers, whom he urges to make a trial of the method by which is avoided the cultivating land one year and allowing it to lie fallow the next. The expense with this system is only 172 pesetas, whereas for ordinary cereal cultivation at least 450 pesetas of working capital are required.

II. The author describes the two great difficulties which Spanish agriculture has to contend with: (1) The low rainfall and its unequal distribution; (2) the absence of humus in the soil, and the impossibility of increasing it by the addition of manure, owing to the insufficient quantity produced by the Spanish cattle. The author alludes to the WITDSOE method and to gives some of the results obtained from the experimental plots on the farm at Valladolid, by the application of the "double-row system" (Plate XLIX, fig. 100 and Plate L, fig. 101). The yields were, from a dry plot: 1st year: 4,513 kg. of wheat (dry crop); 2nd year: 3,610 kg. of vetch, cut and made into hay; 3rd year: 8,150 kg. of wheat after the vetch was cut; and 4th year: 3,700 kg. of spring peas. The average yield for the four years was 5,000 kg. of dry matter per hectare.

The wheat was sown on the "double row system", in groups of two rows with a distance of 13 cm. between each, and each group separated from its neighbour by a path of 42 cm., to enable the necessary tillage to be done. The vetch, being cut green, is grown thickly in equidistant rows, mixed with 10 % of oats, which serve as a support.

The chief advantage of the system is that the numerous light cultivations given to the soil, in order to avoid caking of the surface, and to preserve the soil moisture and destroy weeds, can, by means of the intervening spaces be carried out with the single-furrow light plough patented by the author (Plate L, fig. 102) which is economical owing to the light draught and low wages of the driver.

The water supplied by the rains is less than that necessary to obtain the dry matter produced in the crop, but the deficit is made up by the "atmospheric moisture" or dew. Through the repeated tilling in the "double-row system", the water received by the plots from the atmosphere at the end of the year is of importance, as is shown by DEMSCHINSKY's, GLOVINSKY's and KOSTYTCHEFF's tests. The results of these tests are apparently not in agreement with those of American experimenters, if it be not taken into account that transpiration and absorption are in inverse ratio to the concentration of soil moisture, which concentration may be modified by the fertilisrs. Also QUINTANILLA at the Central Agricultural Station has found the considerable reserve of water retained by surface cultivation, which reserve, in soils 1 metre deep, may be as much as 280,000 litres.

The scarcity of organic matter is overcome by introducing a legume in the crop rotation, which may be sometime dug in, as is done in the rice zone of Valencia, with broad beans, and more often by cutting the legume grown and making it into hay. By this method 3,450 kg. of wheat per hectare and sometimes still larger yields, have been obtained on dry soils. The author cites other results obtained by various cultivators in Castille, hence it is not a question of experimental trials only, since they have been obtained over areas of 160 ha., on shallow, poor, dry soil, and on areas 40 ha. in the case of gravelly soil.

III. — The author recalls the advantages of "dry farming" tillage, and cites some tests made by TULL, SCHLOESING, DUMINT and DÉHÉRIN, and shows that the system of "double-row" cultivation sufficiently supplies crop requirements in climates having an exceedingly low rainfall.

This method has also been tried on the "Colmenares" estate (a suburb of Malaga), planted with olives at intervals of 12 m. The soil is clayey, hard, dry and of medium quality. Only the central spaces and the passages between were sown, the parts under the trees being left (6 ha.) free. Although the trial was made on a comparatively large area 220 kg. more of wheat were obtained on this olive plantation than on the nearest wheat fields. The author gives details relating to this trial and recommends a cereal and legume rotation, digging in lime for the cereals and suitably fertilising the legumes, and considers that both yields and soil fertility will be thus improved. E. M. F.

350. **Rice Growing Without Transplanting.**

JOSHI, F. G. (Superintendent, Ganeshkhund Gardens, Kirkee). *The Agric. Journal of India*, Vol. XIX, Part II, pp. 160-163, figs. 2. Calcutta and London, 1924.

The transplanting of rice is the most costly operation in the production of the crop, but has hitherto been considered necessary.

The author has carried out experiments for five years in which the seed was sown directly in the field, being spaced by means of a field marker, in order to assist weeding.

The marker consists of a wooden roller about 12 inches in diameter,

in which holes are made to take pointed pegs 7 inches in length; these pegs are set at regular intervals in 4 rows along the roller, which may be 6 feet or more in length. The implement is rolled along and leaves holes in the soil for the seeds. This simple implement is quick and accurate.

The land is ploughed after the previous rice crop and is reploughed in preparation for sowing, which is done in May or June. When the lines of plants become visible, the field is weeded by means of a simple modern implement, like a very light plough. When the water is in the field the weeder is again used to stir the land. The plants are thinned where necessary and those removed are used to fill any gaps.

The author carried out experiments at two centres and in cultivators' fields actual records showed that this method of growing rice without transplanting does not lower the yield, and reduces the cost of growing by about 50 %. W. S. G.

351. **Introduction of Milking Machines into Austria.**

DEIBL (Farm-manager). Melkmaschinen mit elektrischem Antrieb. *Wiener landwirtschaftliche Zeitung*, No. 69, one page, 30. August 1924.

GUTSCHMIDT (Dairy-manager in Aschbach). Die Melkmaschine und ihre Vorteile für die Milchwirtschaft. *Milchwirtschaftliche Zeitschrift*, Part 3, 2 pages, 2 illustrations, 5 February 1925, Year 32, Vienna.

The author describes the first experiments made in Austria with the Alfa milking machine, driven by electric power. The following are the conclusions reached:

1. Machine-extracted milk is cleaner than hand-drawn and its hygienic condition is better, more particularly as there is no chance of the admixture of dirty milk.

2. Cows do not in any way resent the use of the machine-milker. They stand quiet and continue to chew the cud during the operation.

3. Milking by machine takes somewhat longer than hand-milking, but on the other hand there is a perceptible lightening of the labour involved.

4. Hand milking is better in so far as the work of milking is in that case always an individual operation, in which account is taken of the special disposition and habits of each cow. It depends for its success however on a thoroughly capable well trained staff of milkers. Where such a staff exists the introduction of milking machines is not to be recommended.

5. On farms where the milkers are only partly trained or completely untrained, or changes are constantly being made, and care is taken that the separate parts of the machines are kept scrupulously clean and thoroughly disinfected, the introduction of milking machines is to be recommended. H. K.

RURAL ECONOMICS.

352. Estate Accountancy.

DUNLOP, Prof. W. R. (Professor of Economics, Imperial College of Tropical Agriculture, Trinidad). *Tropical Agriculture*, Vol. I, No. 4, pp. 58-62; No. 5, pp. 74-78; No. 6, pp. 90-92; No. 7, pp. 106-110; No. 8, pp. 122-125. Trinidad, 1924.

The author draws attention to the lack of systematic and scientific study in relation to accountancy and the actual management of estates. In a series of articles is given a description of scientific accountancy in its application to tropical estates and their administration, the principles and methods being explained in detail.

A long series of very important questions is asked respecting a sugar estate, to answer which necessitates a continuous and uniform costing and statistical system, based upon sound principles.

Accountancy may be divided into three sections: — (*a*) Financial; (*b*) Cost; (*c*) Statistical, although in practice the three classes are inseparable in a properly managed industry.

In the second article, the author considers the form of a Balance Sheet for a large estate, a medium and a small estate and explains the method of double-entry and the distinction which should be drawn between cash, capital and other conceptions underlying financial administration and management of tropical estates. Examples are given of Balance Sheets and various accounts.

The principles of valuation are considered before dealing with cost and value. The value of an estate to a purchaser is its cost to him; when placed on the market the price obtained is the market, or selling value which is the cost value to the new purchaser. The initial cost remains a fixed value, but the owner must know how his capital is apportioned in order to ascertain in what proportion each department is responsible for interest on capital.

In a new estate it is usual to take this cost as a basis of value in the first instance; later on, however, some owners adjust cost to market value. This is wrong, *e. g.*, on a coconut estate the value of each field includes cost of land, clearing, planting and bringing the trees up to the point of productivity. At this point current expenditure on the trees begins, and the estate becomes a going concern. Improvement in yield of the trees increases the value of the estate, but does not increase its cost. Allowance is made for depreciation and additional capital expenditure incurred from time to time.

In drawing up a "statement of affairs" of a new estate, values are assigned to the various assets, the percentage of each is calculated and the percentage figures used to divide proportionately the actual cost price.

It is not desirable to include interest on capital, but to record merely the bare cost.

Estates are generally capitalised when placed on the market, taking as a basis the average profit over a number of years.

It is essential to divide up an estate into sections, as different sections will have different costs and revenue earning values. Since the soil and plant are biologically connected, it is convenient to consider each unit of soil and plant as a single biological factor.

As regards machinery and buildings, cost valuation for the different items in each class should be kept separate, *e. g.* labourers' cottages, overseer's and manager's house and the main machinery units.

With reference to live stock: in the case of working-cattle in the tropics, calves at birth are considered as of no value in cost accountancy. In a dairy herd they are a by-product and have no value, other than the cost of rearing, whereas, in a breeding herd the cost value of the calves at birth is the cost of maintaining the herd.

Depreciation is the difference between original cost and residual value; the rate of depreciation should be placed too high rather than too low. The determination of the rate requires a decision as to the effective life of an asset. On estates there are at least four special cases for consideration: buildings, machinery, trees, crop-ratoons. If a tree is killed the valuation of that section must be reduced by the amount the dead tree cost, less its depreciation to date. In the case of sugar cane ratoons, if the plant-cane crop is made to pay all expenses, then the ratoons have no value. But the original cost of establishing the field of plant-canes can be regarded as capital expenditure, and if the crop yields for five years then the annual depreciation will be $^1/_5$ of the capital.

In the fourth article of the series the author deals with the principles and practice of Financial Costing, which are generally applicable to an estate, although the examples given have reference to coconut production, and specimen accounts of a coconut plantation are given.

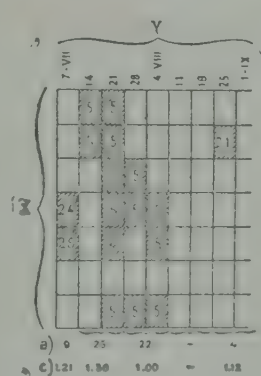

FIG. 103.

y = days in the week;
x = 4weeks in the year.

An annual statement is drawn up of the various accounts, and the value of the system is that a summarised statement of the working and financial position of an estate is provided for each year. The convenience and value of graphic records is illstrated by a part of a chart (fig. 103) kept by a sugar plantation, which shows the days on which subsoil ploughing was done, the acreage and costs.

Cost-records and finance are discussed. In the usual system of bookkeeping, wages, staff expenditure and purchases of materials for immediate consumption are recorded in lump sums. The author advises more detailed records, the selection of accounts and the debit of each with the individual costs, so that a curve can be plotted of costs throughout the crop financial year. However, accountancy can be carried to an extreme, but it is well to distinguish between capital and current expenditure.

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Many managers of tropical estates keep records of what each labourer does each day; of stores bought and consumed; yields of different fields; factory costs; rainfall statistics.

The author gives specimens of headings of the forms and account books recommended, including graphic records.

W. S. G.

AGRICULTURAL INDUSTRIES.

Plant Products.

353. **Progress in Home Brandy Distilling in Lower Austria.**

LÖSCHNIG (Expert Adviser for Wine-making to the Lower Austrian Chamber of Agriculture). Landwirtschaftliche Beispielsbrennereien der n. ö. Landeslandwirtschaftskammer. *Die Landwirtschaft*, Part 1, pp. 2, illustrations 2. **15 January 1925, Vienna.**

With a view to encouraging the systematic economic utilization of all kinds of fruit, and particularly of unmarketable produce such as small cracked plums, a brandy still has been invented by Herr LÖSCHNIG Inspector of Fruit-growing, who has a high reputation for his work in improving fruit cultivation. This type of boiler differs in manny respects from similar apparatus, effects a great saving in work and results in a product of relatively greater value. The provincial Chamber of Agriculture have instituted short courses of one or two days' instruction in the proper use of this apparatus, and in 1924 nearly 2000 farmers took advantage of these courses in distilling.

FIG. 194. — LÖSCHNIG'S distillation boiler.

In the distilleries on the 'LÖSCHNIG system' the boilers are so constructed that the contents can be tipped out and the emptying is thus done quickly. The walls of the boiler and the head are cylindrical and vertical, but in order to secure rapid boiling the vessels are broad and shallow. The base is curved inwards so as get the full benefit

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of the fire, and there is a drainer which rests on the floor of the boiler, for the purpose of preventing the thicker portions of the mash from coming in contact with the hot metal and thus burning. As only the more liquid part of the mash comes into contact with the heated surfaces no stirring is required. The head is large and set somewhat to the side instead of in the middle so as to make it easier to pour the mash into the boiler. At the point where the connecting pipe leading to the condenser is joined to the head an intercalated tin condenser is fixed, which condenses the fusel oil vapour and thus prevents it from passing into the condenser.

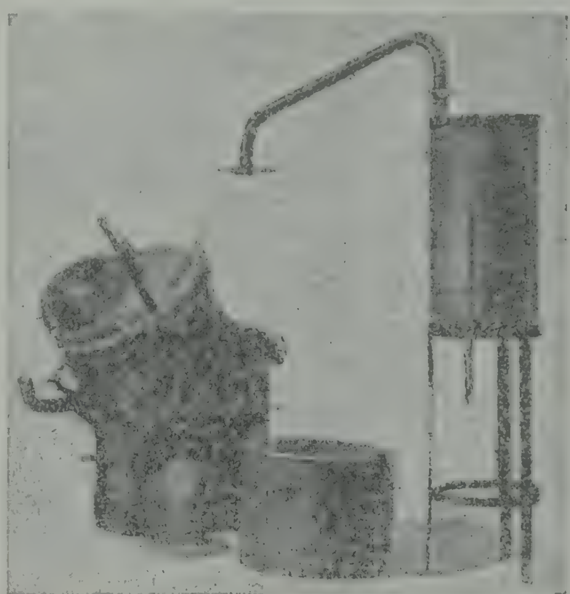

FIG. 105. — LÖSCHNIG'S distillation boiler.

Similarly to prevent the passage of the fusel oil into the condenser, the connecting pipe is so arranged as to pass at a level higher than the condenser. Particles of fusel oil in a state of condensation thus fall back into the boiler. The condenser is amply proportioned so as to be large enough for all requirements. At the outlet an instrument foı determining the specific weight of the brandy is placed, so that it may always be possible to test the strength of the distilled liquor. The condenser is designed on the principle of the countercurrent refrigerator and the boiler is fitted with a thermometer.

H. K.

354. **The Olive Industry in Southern Europe.**

I. CRUESS, W. V. (*University of California, College of Agriculture Circular No.* 278). Olive Pickling in Mediterranean Coutries. pp. 33, figs. 19, bibliography, Berkeley, Cal., 1924.

II. CRUESS, W. V. Preparation and Refining of Olive Oil in Southern Europe. *Ibidem, Circular* 279. pp. 43, figs. 24, bibliography, Berkeley, Cal., 1924.

These publications have been prepared from information obtained and observations made by the author on a recent visit to the olive producing and refining centres of Italy, France and Spain.

The first Bulletin discusses cultural methods, the olive fly, varieties of olives suitable for picking, the French and Greek methods of pickling, and concludes with a description of a simple process for drying olives.

The second Bulletin gives detailed accounts of the olive oil industry, viz., statistics as to the total acreage in Italy, France, Spain, Greece, Por-

tugal, Algeria and Tunis; picking and transport; crushing and pressing equipment and methods followed in the various countries, illustrations and diagrams being given of the plant; by-products, such as pomace, black liquor and settlings from the oil storage tanks; methods of refining; oil standards; packing for transport. W. S. G.

355. **Tambookie Grass for Paper Making.**

ENGLISH, E. F. *South African Journal of Industries*, Vol. VII, No. II, pp. 745-752 figs. 8. Pretoria, 1924.

Amongst the South African raw materials suitable for paper making, tambookie grass (*Hyperhenice glauca* Stent) has been prominent.

An analysis of the oven-dried whole grass gave: cellulose 56-7 %, ash in cellulose 0.95 %, ash in grass 6.04 %.

The grass was pulped on a laboratory scale under the best conditions and gave a yield of 46-47 %, dry pulp on dry grass. The pulp produced is light in colour and can be bleached with less than 10 % of bleach. The yield of bleached pulp under the best conditions was 44-45 %, which compares favourably with that from Spanish Esparto and is higher than that from Algerian Esparto. W. S. G.

356. **The Drying of Rubber; Influence of various Factors in its Preparation; Tests of Methods of treating the Coagulant.**

DE VRIES, O. Onderzoekingen over de opdroginssnelheid van rubber. 1. Invloed van verschillende bereidingsfactoren; proeven over verschillende voor behandelingen van het coagulum. *Archief voor de Rubbercultuure*, Year VII, No. 3, pp. 95-123. Buitenzorg, 1923.

It is well known that the rate of drying of rubber is very variable; the following are data relating to the principal cases presented:

(1) If the recently rolled coagulant be steeped in a solution of 1 % caustic soda, the rate of drying degree is increased, but this treatment has a deleterious effect on the quality of the rubber, causing stickiness.

(2) If rolled in the afternoon, after coagulation, the rubber dries more quickly than that which is rolled the next day.

(3) Soaking in water delays drying; in sheet rubber the drying period is increased from 2 to 4 days to as much as 2-3 weeks.

(4) The thickness of the "crêpe" sheets influences the drying period. The rate of drying is also influenced when the rubber is rolled too tightly; the internal portion remains moist so long that "slowly-drying rubber" is formed, which may take weeks to dry. In practice, the thick edges and corners of the sheets, which remain white and opaque while the remainder of the sheet is completely dry, are simply cut away and kneaded up or sold as remnants.

(5) Pressure greatly retards drying. In the author's tests on extracting the moisture by great hydraulic pressure, a coagulant with 15 % of moisture is obtained which loses no further moisture in the air

(6) The coagulant, which during this operation has been heavily pressed and heated, dries very slowly (7 weeks, instead of 6-10 days).

(7) Spontaneous coagulation produces a "crêpe" which dries somewhat more slowly than that obtained by coagulating with acetic acid.

(8) By keeping the coagulant some time before pressing, and especially before maturing, slowly-drying rubber is produced. All the types of rubber which contain a certain quantity of moisture (sheet rubber, smoked lumps) give a slowly-drying "crêpe"; in the same conditions in which an ordinary "crêpe" dries in a week, a sheet "crêpe" dries in 15-25 days and a smoked lump "crêpe" (Java Para) in 15 days.

(9) Coagulating with alcohol increases the drying period by 25 %.

(10) Coagulating by heating the latex gives a slowly-drying rubber. The drying period for "crêpe" was 13-16 days, while that of the check was 4-6 days.

(11) By adding sulphide or bisulphide of sodium to the latex, drying is slightly retarded. With "crêpe" the difference is small and seldom more than 1 or 2 days; with sheet rubber, if care has not been taken to avoid the use of too large doses of these chemical compounds, the drying period is increased by some days.

(12) Coagulating with sulphuric acid produces rubber which dries more slowly; it was proved that the presence of sulphuric acid was the cause of the increase of the drying period, as is the case with sulphide or bisulphide.

(13) It was found that sodium acetate, which was supposed, on account of its hygroscopicity, to be the cause of slower drying, as also the addition of salts of sodium to the latex, does not influence the drying period. Even in excessive quantities it does not exert much influence.

(14) Coagulating with sodium chloride, or the use of salt-water or sea-water for diluting the latex produces a very slowly-drying rubber.

(15) Alum, or water containing this coagulant, may also be the cause of slow drying. Alum may cause a delay of from 13 to 41 days.

The author has made a series of tests on the influence of the various treatments of the coagulant and has also made investigations to ascertain whether there is any connection between the rate of drying and the hygroscopicity of the rubber. The results of these tests are summarised below:

Moisture may be reduced by keeping the recently rolled sheet in alcohol or in diluted formalin (1 : 10 or 1 : 100). Keeping it in a 10 % solution of acetic or a 5 % solution of alum slightly reduces the drying period, but this may be partially or totally caused by the loss in weight by contraction when the coagulant is kept in these solutions.

The length of time that rubber is kept in water increases the drying period from 4 to 6 or 10 days, 3 days' steeping causes an extension of the drying period of from 5 to 11, or from 4 to 18 days, and a weeks' soaking gives a very slowly-drying rubber; sheets of ordinary thickness take 1 ½-2 months to dry in the air.

The degree of dryness is slightly decreased by keeping the rubber in 1 % acetic acid, 5 % sulphide or bisulphide of sodium, 1 % chinosol, and

9 % caustic soda. By keeping the recently rolled coagulant in a moist atmosphere over water the drying rate is retarded. By keeping it over serum dryness may be increased or decreased; an atmosphere of coal gas or carbonic anhydride increases dryness; keeping in a closed bottle (in which the oxygen is soon absorbed) gives contradictory results, on which further investigation is necessary. By adding formalin to the latex, drying is not delayed to such an extent. The coagulant formed from very diluted latex may dry as quickly as ordinary coagulant. The coagulant drying slowly through being kept in water may dry quickly by being afterwards treated with alcohol. Subsequent treatment in formalin (1 : 10), 10 % acetic acid, 5 % alum, has little or no effect. A coagulant which dries more quickly by being kept in formalin (1 : 10) or alcohol, dries more slowly after a subsequent treatment with water, but not so slowly as fresh coagulant treated with water. Thus, an air-dried sheet dries slowly if it has been kept a certain time under water.

During treatment (keeping in different solutions or in a bottle) the coagulant loses 10-15 % in weight, the greater part owing to contraction, a small part through the expulsion of serous matter.

Micro-organisms take no part in the production of slowly-drying coagulant; this phenomenon always takes place in the same manner under conditions in which the action of micro-organisms is absolutely excluded (disinfection by boiling, treatment with alcohol, or formalin).

The hygroscopicity of rubber (its content of hygroscopic serous matter or hygroscopic matter formed during its preparation) influences the moisture content of air-dried rubber, but has no appreciable influence on the degree of dryness and is not the determining cause of slowly-drying rubber. Rubber which dries more slowly is obtained by treating for a long period in water, by which treatment the hygroscopic matter is to a great extent driven off.

The causes of the slow-drying phenomenon must be in the structural changes of the coagulant, or, more exactly, slow-drying is not due to the formation of an impervious surface layer, but to a structural change of the whole mass.

F. C.

357. **Experimental Timber Preservation in South Africa.**

STEPHENS, H. B. (Forest Department). *South African Journal of Industries* Vol. VI, No. 10, pp. 650-656, and *Ibidem*, No. 11, pp. 736-744, plates 10. Pretoria, 1914.

In the first article the author discusses the need for timber preservation, the agencies destructive to timber, preparations and methods of preservation, and describes the plant at the Experimental Timber Preservative Station, Pretoria.

The article shows the increased service yielded by treated timbers and the importance of tests, and describes the open tank and pressure treatments and the effects of strength of solution and wood structure on absorption. The costs of treatment are discussed and a description is given of special

experiments for the control of boring beetles, white ants, fire, and the preservation of mining timbers and railway sleepers. W. S. G.

Animal Products.

358. **Measurement of Hydrion Concentration in Dairy Products with Biilmann's Quinhydrone Electrode.**

LESTER V. (University Institute of Hygiene, Copenhagen). *Journal of Agricultural Science*, Vol. XIV, Part 4, pp. 634-641, figs. 3, tables 6, bibliography. London, 1924.

The estimation of the hydrion concentration of milk, cream, whey and buttermilk has hitherto presented technical difficulties, and has been open to error, largely owing to the time taken, during which the reaction of the milk or other liquid changes.

The results of a series of experiments on the hydrion concentration of various dairy products, in which BIILMANN's Quinhydrone Electrode and HOBER-HASSELBLACH's Hydrogen Electrode were employed, were as under :

The results of the tests agreed, no difference being found in the reaction or buffer action of fresh or heated milk. The HOBER-HASSELBLACH method is slow, in consequence of which there is risk of the reaction of the liquid changing during the test. Also there is risk of too high *p*H values owing to loss of CO_2. BIILMANN's Quinhydrone Electrode is quick, easy and simple and avoids the above sources of error. It is especially well adapted for titrations, as it allows of a large number of estimations being carried out in a short time.

Details of experiments are given in the article. W. S. G.

359. ***Oidium variicolor*, a New Mould in Milk and Milk Products.**

PROKS, J. (Lactological Institute of the Czech Polytechnical School, Prague). *Le Lait*, Year 4, Vol. IV, No. 38, pp. 640-643. Lyons, 1924.

The coloured varieties of *Oidium* mould found in milk and milk products are : *Oidium aurantiacum* (brick red), *Oidium rubrum* (blood-red) and blue lactic *Oidium.*

During the bacteriological analysis of a defective butter, the author isolated a mould of the *Oidium* species which differs remarkably in its colouring properties from the moulds of this species hitherto described.

When cultivated on white curd cheese, the mould reveals the following under the microscope : the mycelium forms arborescent filaments of a violet tinge. As soon as the mould matures, the filaments develop typical oidia at the extremities : they are either rectangular or oval. The formation of oidia is very abundant ; they have a faint violet tinge. The contents of the cells of the filaments and oidia are easily coloured by carbol fuchsin ; the membranes are difficult to colour, for they are thick and strongly refract light rays.

The author then gives the development characteristics of the mould in the different nutrient mediums; observation shows that the mould changes colour during growth: violet-pink, violet and then blue.

The *Oidium varicolor* shows poor development on acid or alkaline nutrient mediums, but thrives better on neutral or very slightly acid nutrient mediums; in this it differs from the *Oidium lactis*, which develops badly on neutral or alkaline nutrient mediums and only grows on slightly acid nutrient mediums.

In spite of the abundant formation of oidia and their easy separation, this mould is found very rarely. P. D

360. **The Freezing Point of Sudan Milk.**

JOSEPH, A. F. & MARTIN, F. J. *The Analyst*, Vol. XLIX, No. 682, pp. 240-423, bibl. Cambridge, 1924.

The authors have made a cryoscopic examination of cow's milk from tropical countries. This milk is generally richer in fat and total solids minus fat than that of countries with a temperate climate. For this test the authors used 51 animals belonging to three different races: Damietta, cross-bred Shorthorn and a native breed from the Khartum district. Their researches led to the following conclusions as regards the freezing point:

(1) The freezing point of the Sudan cow's milk is practically the same as that of cow's milk from the United States.

(2) The "race" factor has scarcely any bearing regards the freezing point.

(3) Different portions of the same milking have the same freezing point.

(4) The lactation period has only a very slight influence on the freezing point.

(5) The freezing point of goat's and ewe's milk is lower than that of cow's milk, while that of ass's and cow's milk is the same.

(6) Abnormal results, due to the rapid development of acidity in warm climates, may be avoided by the use of chloride of mercury at 1 : 2000. P. D.

361. **Reducing and Oxydising Reactions in Milk.**

HAAS, P. and LEE, B. (Botanical Department of University College London). Further Observations on Certain Reducing and Oxidising Reactions in Milk. *The Biochemical Journal*, Vol. XVIII, Nos. 3-4, pp. [illegible], 1 fig. Cambridge, 1924.

One of the authors in collaboration with HILL had observed in milk the presence of a substance with oxidising reactions similar to those of peroxydase, which it may be regarded as resembling. To this substance the name of "istase" was given. Further experiments, however, show that "istase" and peroxidase, although both possessing the properties

of being inactive under boiling and of remaining in the serum, are not identical and can even be separated.

In oxidation of the nitrites by the milk, in the presence of acetaldehyde and oxygen the function of the istase is to produce a peroxide of the aldehyde: from that point of view, it may be compared with the supposed oxygenase of the oxidase of plants.

The oxidation of the nitrites accordingly results from the combined action of the peroxide thus formed and from the peroxidase and not from the action of the istase by itself. A solution containing istase and peroxidase, but not peroxide, does not oxidise nitrites, whereas nitrites are oxidised by a solution containing peroxidase, but not istase, when oxygenated water is added to it. A. F.

362. **Cause and Prevention of Disagreeable Flavours of Butter.**

GIBSON, A. L. (Professor of Dairy Chemistry, Ontario Agricultural College, Guelph). The Chemistry of some Butter Defects. *Scientific Agriculture*, Vol. 5, No. 2, pp. 57-61. Ottawa, Ontario, 1924.

The author has ascertained that the tallowy flavour of butter is due to oxidation, which oxidises not only olein, but also the glycerol produced by hydrolysis of the fatty matter.

The oxidation of glycerol produces glycolic acid.

It should be stated that:

(1) exposing cream and butter to the simultaneous action of the air, light and a high temperature, favours oxidation;

(2) lactose in a neutral or slightly alkaline medium is highly favorable to oxidation;

(3) butter made under good conditions, with fresh cream at a reasonable degree of acidity, cannot acquire the tallowy flavour through the presence of lactose, as lactic acid acts as a slight preservative;

(4) copper and its alloys, bronze and nickel, as also the salts of these metals acting on butter in consequence of the excess of acidity in the cream, act as catalytic agents of oxidation. Iron and its compounds favour oxidation in the same way, but their action is weaker;

(5) abnormal alkalinity of cream or butter increases the oxidation;

(6) casein, in combination with copper and its salts, but not alone, facilitates the production of the tallowy flavour and is the cause of the pink or brownish colour in the last stages of development.

The most generally accepted opinion at present is that a fishy flavour is caused by trimethylamine, the basal substance of which is lecithin. Through partial hydrolysis lecithin gives choline, the oxidation of which forms trimethylamine.

The conditions which favour or give rise to a fishy flavour of butter are:

(1) high acidity of the cream;

(2) high salt content of butter; salt intensifies the flavours and increases the solubility of lecithin;

(3) excessive churning of the butter, which increases the air content of the butter ;

(4) the presence of salts of iron and copper which act as catalysers in the oxidation of the choline.

Butter made with pasteurised cream does not so quickly assume the fishy flavour ; pasteurisation causes lecithin to absorb oxygen, and lecithin become less soluble ; pasteurisation causes a partial hydrolysis of the lecithin and the formation of soluble substances in the buttermilk, consequently the lecithin content of butter made with pasteurised cream is too slight to bring about the formation of a sufficient quantity of trimethylamine to produce a fishy flavour.

The preventive measures against these flavours, which depreciate the market price of butter are :

(1) the use of fresh cream in making butter ;

(2) the avoidance of completing the process of manufacture by using chemical or other substances ; neutralisers are useless if fresh cream is used ;

(3) the pasteurisation of the cream, and if it is desired to obtain a certain degree of acidity, treatment with pure cultures ;

(4) care not to bring the cream into contact with badly-tinned or copper receptacles ;

(5) the avoidance of excessive salting ;

(6) the avoidance of excessive churning ;

(7) the utmost cleanliness. P. D.

363. **Cheese Control Experiments.**

I. IBSEN, CHR. H. Ostekontrolforsog. 115*te Beretning fra Forsøjskeles Laboratorium for Landøkonomiste Forsøg* No. 115, pp. 1-25, tables 8. Copenhagen, 1924.

II. ANDERSEN, A. C. and WINTHER, J. E. Om Bestemmelse af Fedt og Torstosi Ost. *Ibidem*, pp. 26-66, tables 3, bibliography. Copenhagen, 1924.

I. At a meeting of the Government Agricultural Committee held in the spring of 1921 it was decided that the Experimental Laboratory should carry out experiments on curd production in order to obtain data relative to the fat-content and compounds present in milk which are essential for cheese-making, so that cheese-producers may have confidence in the fat-content minimum as stipulated in the publication of the Ministry of Agriculture of June, 2, 1921. Experiments were made at 8 dairies, extending over 2-3 days in the case of each of the 4 kinds of cheese (45-30-20-10 per cent. fat in dry matter), and on the basis of the data obtained it was decided to publish a table as a *provisional report* from the Experimental Laboratory. At the same time it was resolved that the Laboratory should repeat and check the experiments under practical conditions, for a year.

In order to explain the figures contained in the provisional table, a brief abstract is given below from data relative to cheese having a fat content of 45 % in dry matter.

TABLE I. — *Fat content and constituents of Milk for Cheese Making. 45 % fat in dry matter, 30 % fat in dry matter per 1000 kg. of milk for cheese-making.*

fat in whole milk	protein in whole milk	fat in milk for cheese making	whole milk	skim milk	butter milk
%	%	%	kg.	kg.	kg.
4.00	3.38	3 07	761	219	20
3.90	3.33	3.03	770	210	20
3.80	3.28	2.99	781	199	20
—	—	—	—	—	—
—	—	—	—	—	—
3.00	2.88	2.69	893	87	20

The above data show for each of the 4 types of cheese (*a*) the percentage of fat and protein for whole-milk intended for curd-making, (*b*) the percentage of fat required in ready-mixed milk for cheese making, and (*c*) the amounts of these constituents which should be present per kg. of whole-milk, skim-milk and butter-milk. It may be noticed that the figures for the fat content of whole-milk vary from 4.0-3 % fat, below which limits the milk from Danish cows very seldom falls.

In the course of a year 105 experiments on curd-making were carried out at 44 dairies in the country, to ascertain whether the figures given in the provisional report were sufficiently trustworthy for the practical work of the dairies. Amongst the various types of cheese the following number of curd tests were carried out :

45 % fat in dry matter	15	tests
30 % » » »	40	»
20 % » » »	34	»
10 % » » »	16	»

From data resulting from the above experiments the figures given in Table II were calculated.

TABLE II. — *Fat content of milk for cheese-making.*

Fat content of whole-milk	Fat content of Milk			10 % fat in dry matter	
	45 % fat in dry matter	30 % fat in dry matter	20 % fat in dry matter	fat content of milk	When whole milk is added
4.00	3.10	1.65	1.00	0.50	10.0
3.90	3.05	1.65	1.00	0.49	10.1
3.80	3.05	1.60	0.95	0.49	10.2
3.70	3.00	1.60	0.95	0.48	10.3
3.60	2.95	1.55	0.90	0.47	10.4
3.50	2.95	1.55	0.90	0.47	10.5
3.40	2.90	1.50	0.90	0.46	10.7
3.30	2.85	1.45	0.85	0.45	10.8
3.20	2.85	1.45	0.85	0.45	10.9

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It has been suggested that in Table I it would be better to omit all reference to protein and to give only the fat percentage required in the milk.

This suggestion has been taken into consideration in compiling Table II, which gives the fat content of milk necessary under ordinary circumstances for cheese production. The percentage of fat in dry matter does not fall below the stipulated minimum, but allowance must be made in such cases where the quantity of protein is exceptionally large, and where unusual methods of curd-making are employed, or where Jersey milk is added. Furthermore, it must be taken into consideration that cheeses are not always homogeneous. *With these reservations the Laboratory recommends Table II.* As to the three first types of cheese only the fat content required in the milk is given, when the whole-milk has the fat content stated in the first column on the left.

As regards cheese with 10 % fat in dry matter, data are given on the right, relative to the addition of whole-milk, as difficulty has been found at the dairies in estimating the fat content by the GERBER method.

II. When the Government control of cheese production was started in 1921, the samples of cheese taken for examination and the chemical analyses were referred to the chemical department of the Laboratory, which had in consequence to undertake the determination on a large scale of the fat and dry matter in cheese.

It was recognised that the method usually employed in all laboratories for the estimation of dry matter must be adopted, viz., drying on pumice of the weighed, broken curd, at a constant temperature of 98-100°C. In the case of fat determinations, however, the ordinary method of SCHMID-BRODZYNSKI-RADZLAFF (called S.B.R. method) is too slow and expensive for large scale examinations.

It was seen that use would have to be made of one of the so-called practical methods which allow of numerous determinations being made in more reasonable time and with far less expense, although the result is less exact. The choice had to be made between the method of VAN GULIK and that of COOPER, exact fat determinations by the S.B.R method being made at the same time.

The following conclusions were drawn:

(1) As a result of careful estimations of the fat content of hard cheeses it was found that duplicate determinations, only in one case out of three on an average, deviate more than about 0.07 and in one case out of twenty, more than 0.15.

The same will be found to be the case as regards moisture determinations, except with Rochefort cheeses where deviations of about double the above may be found, while the determinations of moisture do not deviate much more than those of hard cheeses.

(2) On the determination of fat in dry matter this variation as regards hard cheeses involves uncertainty to such a degree that, if from the average results of two fat and two moisture determinations is calculated,

the fat content in dry matter, F., a repetition of the determination under the same conditions and on the same sample of cheese will with:

a probability of	2/3	lie between	F + 0.1	and	F — 0.1
» » »	19/20	» »	F + 0.2	and	F — 0.2
» » »	997/1000	» »	F + 0.3	and	F — 0.3

As regards Rochefort cheese the limits must be calculated at 0.2, 0.4 and 0.7 instead of 0.1, 0.2 and 0.3.

(3) Each individual cheese proved to be so non-homogeneous that considerable differences in the results of testing are inevitable. If the fat content of the dry matter in a hard cheese is estimated from two fat and two water determinations and the value F is thus found, by repeating the determination under the same conditions, but on another sample of the same cheese, a result will be obtained the value of which will with

a probability of	2/3	lie between	F + 0.2	and	F — 0.2
» » »	19/20	» »	F + 0.4	»	F — 0.4
» » »	997/1000	» »	» + 0.6	»	F — 0.6

Rochefort cheeses must be calculated with a variation three times as large, consequently with the limits 0.6, 1.2 and 1.8 instead of 0.2, 0.4 and 0.6.

(4) As a quick method van GULIK's modification of the GERBER method is to be preferred to that of COOPER, especially if it is not a case of large scale examinations.

(5) The results of van GULIK's method compare very well with the results of the S.B.R. method for cheese with 30-40 % of fat in dry matter. With a very high fat content van GULIK's method on an average shows more, in skimmed cheeses, however, less that the S.B.R. method.

(6) Simultaneously executed analyses made by the GERBER-van GULIK method on the same grated cheese sample, will only on an average in one case out of 20 deviate more than 0.2. Nevertheless, the GERBER-van GULIK's method must be reckoned to be subject to experimental errors four times as great as the S.B.R. method.

Provided the "fat content in dry matter" in a cheese is found partly from the mean of the two fat determinations by the S.B.R. method and the mean of two moisture determinations, and partly from the mean of two fat determinations of GERBER-van GULIK's method and the mean of two moisture determinations, together with the application of the above-mentioned corrections, the difference between the two values of fat in dry matter will on an average in

2	cases	out of	3	be	less than	0.4
16	»	»	20	»	»	0.8
997	»	»	1000	»	»	1.2

These limits only apply to hard cheeses. The figures for Rochefort cheeses must be multiplied by about 1.5.

The working method of the Government Cheese Control is as follows: the taste-sample taken out by the Controlling Authority with a cheese-scoop is examined by means of the GERBER-van GULIK method, while the more accurate but more elaborate method, will only be employed for the cheese-sector cut out in larger pieces, which perhaps may be sent in for after-control. Deviations as mentioned above between the stated fat content in dry matter, in respectively the taste-sample and the sector, will prove unavoidable, but the experimental error having a double sign, there is just as much probability that the examination of the sector-sample will give a larger fat content in the dry matter, as there is that it will lead to a smaller content of fat in the dry matter, or that it will show a smaller content of fat in the dry matter than that proved by the taste-sample.

In the case of examination of especially non-homogeneous cheeses, wider limits for errors than those stated must be reckoned with.

(Denmark Corr.)

364. **On the Flora and Preparation Processes of Kephir.**

SANCHEZ, G. (Laboratoire et Biothérapie lactique, Carrion et Laguel). *Le Lait*, Year 4, Vol. IV, No. 38, pp. 621-626, Lyons. 1924.

The author considers that the combination of chemical, physical, biological and dietetic qualities which characterise the best kephir, enable three categories of species to be distinguished:

A. *Lactic ferments*: 2 diplococci and a chain generally formed of 6-8 rather large cocci. The organisms are Gram positive; coagulate milk; the acidity produced is not above 1 % of lactic acid. The curd given is of the comparative inconsistency and slight tendancy to crumble indicative of good kephir. The diplococci develop a delicate aroma and the chain-form dissolves the casein to a certain extent.

B. *A yeast* producing carbonic acid and traces of alcohol; it alone ferments milk and does not cause the slightest flavour of beer.

C. A special bacillus, similar in properties to *Bacillus caucasicus*. It coagulates casein, which is dissolved and peptonised to a rather marked degree. It is mobile and acidifies the surrounding medium. An in-curved slightly mobile bacterium, found by the author in kephir grains, seems to be related to the *Bacillus cacasicus* species.

According to the author, many species found at the surface, or at a depth in the kephir grain, must be regarded as taking no part in the real kephir fermentation, such for instance as the glairy, lactic streptococcus, a pink torula, yellow sarcinae, various species of oidium, *Mycoderma aceti*, fungi such as *Aspergillus*, *Penicillium*, and sporulating organisms such as *Bacillus butyricus*.

After isolating some grains and keeping them is strictly pure cultures the author succeeded in obtaining the ferments, which, after mixing in suitable proportions were inoculated into milk which had been sterilised

by heating to about 100°C., the milk being then poured into flasks which had been sterilised in the autoclave.

These flasks were closed and placed in an automatically regulated oven, when a remarkably constant kephir was produced of the the most desirable quality. Neither during fermentation nor afterwards were any parasitic ferments found, capable of injuring kephir produced direct from the grains. P. D.

365. **The Citric Acid Content of Milk Powder.**

STEUART, D. W. *The Analyst*, Vol. XLIX, No. 583, pp. 465-467. Cambridge, 1924.

In his researches, the author has used STAHRE's pentabromaceton method and BEAU's mercury sulphate method. He observed that the citric acid content of milk powders is very high, and equal to about $^1/_5$ of the ash. A sample of fresh milk gives 0.158 % of anhydrous citric acid. Whole milk powders give an average of 1.16 % and skimmed milk powders 1.56 %, or together 0.144 % in the milk which has served for making the powder. P. D.

366. **General Review of Milk Butter and Cheese in Egypt.**

AZADIAN, A. (Chemist, Public Health Department of Cairo). *Annales des falsifications et des fraudes*, Year 17, No. 192, pp. 528-538. Paris, 1924.

In Egypt, cow's milk, buffalo's milk, and to a less extent, goat's milk are utilised. In the towns the milk is supplied to the inhabitants by three classes of vendors:

(1) The dairies, belonging to Europeans.

(2) The native vendors, who go round on foot or riding on an ass with 2 wooden vessels containing about 25 litres of milk.

(3) The cowherds who go round with a cow accompanied by its calf, selling the milk from the udder.

There are also herds of goats, the milk of which is also sold from the udder.

A milk control was instituted by the Public Health Department about 10 years ago; the Inspector's Office of the City of Cairo carries out this work. The samples of milk are taken by the sanitary inspector or by the sanitary officers of the various districts.

In 1923 the total number of samples inspected was 1135, of which 800 (77 %) were normal, 95 diluted (9 %), 124 skimmed (12 %), and 26 diluted and skimmed (2 %); a total of 242 adulterated samples, or about 23 %. There were also 15 abnormal samples and 75 doubtful.

The following figures are the results of an analysis of 61 samples of buffalo's milk; each sample is a mixture of the complete milking of 6 animals:

	Minimum	Maximum	Average
Specific weight	1.0294	1.0343	[illegible]
Total Solids	15.81	19.75	[illegible]
Fat	6.05	9.75	[illegible]
Solids less fat	9.42	10.40	[illegible]
Lactose	4.65	5.16	[illegible]
Albuminoids	3.57	4.80	[illegible]
Ash	0.70	0.84	[illegible]
Alkalinity of Ash	7.2	9.2	[illegible]
Chlorides	0.04	0.10	[illegible]

The minimum requirement for a normal buffalo's milk is fat 5 %; solids less fat 8.5 %.

149 individual samples of cow's milk gave:

	Minimum	Maximum	Average
Total solids	9.25	20.55	14.63
Fat	0.60	11.00	5.44
Solids less fat	7.55	10.95	9.19
Refraction of serum at 30° C.	30.7	39.8	36.94

It should be observed that these were individual samples and that therefore many factors were influential, such as: temperature, age, feed, time of milking, and especially of feeding. The dairy farmer often gives the cheapest possible feed, *i. e.* "bouza" waste ("bouza" is an alcoholic drink prepared from fermented bread); in good cowhouses, on the contrary sesame cake and good hay are fed.

The minimum requirement for normal cow's milk is: fat, 3 %; total solids less fat, 8.5 %.

The milk of goats which are led through the streets is always very poor and the variation in composition is great, for the feed leaves much to be desired. The minimum requirement for goats' milk is: fat 2.50 %; total solids, 7.50 %.

The analysis in general use includes the following determinations: total solids estimation of fat content by the GERBER method and refraction of serum by the ACKERMANN method; if a contra-analysis is made, GOTTLIEB's method is used for fat estimations.

Butter: There are two kinds of butter on the market: full cream butter and "brèche" butter, which has not such a good flavour and turns rancid more easily. The natives use melted butter, "Samna" or "Semn" for the kitchen, taking in a stock from February to March for the whole year.

The butter is prepared by the peasants or fellaheen in a primitive

way. On being sent to town, it is mixed, melted and the contained water evaporated; it is then salted and poured into pots and hermetically sealed. At the bottom of the cauldron in which the melting takes place, a casein product called "morta" remains.

The butter is mostly made from buffalo's milk and is white, unless it has been coloured with curcuma. When well made it is firm and granular and has a pleasant flavour and smell.

There are no laws in Egypt regulating the sale of butter, and that sold on the market contains a large percentage of water.

Analysis of buffalo's and cow's milk in Egypt.

	Buffalo's milk			Cow's milk		
	Minimum	Maximum	Average	Minimum	Maximum	Average
Zeiss at 40° C.	40.4	44.0	42.5	40.6	45.3	42.9
Reichert	24.5	37.5	31.2	21.3	31.6	26.1
Polenske	1.0	2.8	1.5	1.0	2.8	2.1
Saponification	218	235	229	213	237	227
Hubl.	23.0	39.7	31.4	24.1	44,5	34.4

Cheese: All kinds of cheese are found on the Cairo market, especially the Balkan or Greek cheese.

The cheese mostly made in the Country is the soft white variety. Either whole milk, or milk partially or completely skimmed are used. There are several varieties of white cheese, all being preserved in salt water:

(*a*) the "stambolli": in square blocks of 250-300 gms., or round cheeses of 150-200 gms.

(*b*) the "halum": prepared by the fellaheen and containing a high percentage of water;

(*c*) the "Damietta": in small balls of 30-40 gms.

The *seret*, fairly well made, is also sold nearly everywhere.

There is also a preserved cheese, or "guibnetmesh": the white cheese is put into earthenware receptacles, milk, salt and Cayenne pepper are added, and the receptacles are then closed hermetically.

Instead of milk, water and a little "morta" may be added.

The hermetically sealed pots are kept at least 6 months; at the end of this period they are opened, the quantity for the day's consumption is taken out and a little sauce or "mesh" is added. P. D.

367. **The Preservation of Shelled Eggs.**

COUDIS. C. H. *La Hacienda*, Vol. XIX, No. 11, pp. 234-327, figs. 4. Buffalo, N. Y., U. S. A., 1924.

The author considers that about 20 000 million eggs are produced annually in North America, of which many are spoilt in transport, through

exposure to the weather and the treatment they undergo before consumption. The author then mentions the great value of this "complete food" owing to its content in protein, vitamines, fats and mineral salts.

Dr. M. E. PENNINGTON (of the Food Research Laboratory) was appointed by the United States Government to carry out investigations for the purpose of avoiding this loss, and concluded, from experiments made by TITMAN that the best means of preserving eggs was to shell them while fresh and keep them in cold storage.

This process is being developed on a large scale by TITMAN at Boston. Large quantities of fresh eggs are received daily, especially in spring and summer. They are all examined with special ovoscopes by means of which it can be ascertained whether they are good or not. Those rejected are sent through tubes to the lower floor of the building. The good eggs are sent to the shelling room, which is kept at a temperature of 19°C. Each operator shells 6,000 eggs daily; the factory can prepare and pack 500 000 daily. As soon as the shell is broken the contents are poured into antiseptic basins, again examined and all those which are unsound are rejected, and the remainder are poured together into receptacles which, as they are filled, are sent to an electric mixer. A uniform and homogenous liquid is formed and poured into 30-lb. tins, which are immediately sent to the refrigerating rooms where they are kept at a temperature of — 22°C. The installation of the establishment is supplied with all kinds of disinfectant material, refrigerator wagons, elevators, etc. E. M. F.

PLANT DISEASES.

Plant Parasites.

368. **Field and Forest Plant Diseases, especially those of Plants Cultivated in Belgium and the Belgian Congo.**

MARCHAL E. Eléments de Pathologie végétale appliquée à l'Agronomie et à la Sylviculture (Bibliothèque agronomique belge, No. 2). One Vol., octavo, of XVI + 312 pp., with 148 figs. in the text. J. Duculot, Gembloux, 1925.

In this book, intended for general use but written on a scientific basis, the author, who is a Professor at the Agricultural Institute at Gembloux and also Director of the Government Station of Phytopathology situated in the same town, proposed not only to summarise the progress made up to recent years in Plant Pathology in Europe and still more in the United States of America, but also to bring together for the first time in a hand-book descriptions of parasitic plant diseases and the non-parasitic or physiological diseases which more especially attack field, garden, fruit and forest plants cultivated in Belgium and Belgian Congo, without

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however omitting matters of interest from a phytopathological point of view in other countries.

The book is divided into three parts: In the first part, after having treated of parasitism and parasites in general, as well as of various preventive means adopted against the latter, the author passes in review successively the principal species of Bacteria, Mixomycetes, Fungi, Algae, Lichens and Phanerogams living as parasites on cultivated plants, including the following: cotton, cocoa, *hevea*, palms (coconut, *elaeis*, *phoenix chamaerops*), coffee, tea, sugarcane, etc. In the appendix to the study of the parasitic diseases of plant origin, the more important virus diseases to which tobacco, tomatoes, sugar-cane, etc., as well as the potatoes are subject, are examined.

The second part deals with the more important non-parasitic and physiological diseases attributed to environmental factors, such as soil, light, heat, atmosphere (and in particular, owing to the presence of sulphurous anhydride, in addition to acids and various matters, dusts, generally of industrial origin), meteorological factors, and lesions from various causes determining the total or partial loss of some tissues or organs of the plant.

The last part consists of a series of tables based on external characters, which enable one to determine the parasitic diseases of plant origin which are mostly found on plants cultivated in Belgium and the more important plants, from an economic point of view, of the Belgian Congo.

A detailed index of the contents of the volume is given. G. T.

369. ***Sclerotium monohistum*** **n. sp., a Maize Parasite, in Morocco.**

MARESQUELLE. Sur un *Sclerotium* parasite du maïs. *Revue de Pathologie végétale et d'Entomologie agricole*, Vol. XI, Part 2, pp. 156-159, Fig. 1. Paris, 1924.

During the latter part of the summer of 1923, the Institute of Plant Pathology at Paris received from Rabat (Morocco) a fragment of corncob attacked by an unknown disease: the centre of the cob was full of black granules, which had spread along the vascular bundles and the disease was recognised by the author as sclerotium. From a culture of these were quickly and repeatedly obtained a delicate mycelium and numerous sclerotia, in appearance identical with those found in the cob. The attempts to inoculate maize and other cereals gave negative results.

The author considers the cause of the disease to be a new species of *Sclerotium*, to which he gives the name of *Scl. monohistum* from the fact that it differs from other species of *Sclerotium* in having a distinctly homogeneous structure, that is, without any separation into an external cortical stratum and an inner medullary mass. G. T.

370. **Bacterium sp. and *Coccus* sp. injurious to Beans in Costa Rica.**

PICADO, C. Une maladie des haricots (Association bactérienne parasitaire d'especes antagonistes en vie libre). *Revue de Pathologie végétale et d'Entomologie agricole*, Vol. XI, Part 2, pp. 150-155, Tables 2. Paris, 1924.

Bean crops are often severely damaged in Costa Rica by a disease known locally as "hielo" (ice), because it is popularly supposed to be

due to a sudden fall in temperature. When the disease is of an acute character, the plants wither and die from day to day; at other times the plant survives, but has a poor appearance and yields little or no fruit. The disease is characterised by dry scars resembling burns, situated in those parts of the stems which are underground; sometimes there is a single scar equal in width to the stem; in other cases there is a large number of small brown spots. The disease may be examined when the crops are gathered. The plant, on being pulled up from the ground, breaks off at the level of the scar, where the whole parenchyma is disorganised. In longitudinal sections of the stem the vessels are brown in colour for a length of some centimetres.

An examination of the sap of the diseased tissues reveals the presence of two distinct bacterial forms (*Bacterium* sp. and *Coccus* sp.), of which cultures have been made and isolated.

Tests clearly proved that *Coccus* sp. may be associated with *Bacterium* sp. in the spontaneous or experimental disease (direct inoculation), but that only *Bacterium* sp. can cause the disease, which should therefore be considered as the pathogenical agent of the disease. Further tests showed that *Bacterium* sp. and *Coccus* sp., associated as parasites, become antagonistic in their independent existence in the soil, and that the *Coccus* sp. destroy the *Bacterium* sp.

It is sufficient to contaminate the bean seeds before sowing with *Coccus* sp. in order to destroy the pathogenical agent (*Bacterium* sp.) and prevent the disease from breaking out. G. T.

371. *Sclerotium* sp. injurious to the Sugar Beet, in Morocco.

BARBIER A. M. Sur une altération de la betterave causée par un *Sclerotium*. *Revue de Pathologie végétale et d'Entomologie agricole*, Vol. XI, Part 2, pp. 160-163, Table 1. Paris, 1924.

Sugar-beet roots, sent in June, 1923, from Rabat (Morocco), to the Station of Plant Pathology at Paris, showed small black excrescences, mostly situated on the line of insertion of the roots.

Section of the diseased parts reveal small groups of sclerotia in the upper tissues of the parasite.

In culture, these sclerotia develop a mycelium, from which new sclerotia soon form.

From the form of the sclerotia, the fungus which appeared on the sugar-beet in Morocco resembles *Sclerotium Oryzae* Catt. and differs, on the other hand, from *Scl. Rolfsii* Sacc. and *Scl. cepivorum* Berk. G. T.

372. *Mauginiella Scaettae* n. gen. and n. sp., a Hyphomycete injurious to the Date Palm, in Cyrenaica.

CAVARA, F. Floral atrophy in the Cyrenaican "Phoenix dactylifera". *Rendiconti delle sedute della Reale Accademia Nazionale dei Lincei*, Vol. 1, 1st session, Part 2, pp. 65-67. Rome, 1925.

During the spring of 1924, in some palm groves in the neighbourhood of Bengasi (Cyrenaica) arrested growth was noticed in the male inflorescence

ces of *Phoenix dactylifera*, the spathe failing to open, or the flowers being completely atrophied, whence it was impossible to utilise the inflorescences themselves for the practice of artificial pollination.

Under a microscopical examination, the secondary axes of these inflorescences appeared cloudy white in colour over the whole of the upper portion, with blackish spots disseminated with white tufts in the lower portion. Large blackish spots were also observed on the principal axis.

The white down which mostly covered the extremity of the secondary floral axes, showed under the microscope the presence of conidia belonging to a hyphomycete, considered by the author to be the cause of the floral atrophy of the date palm. The parasite has an endogenous mycelium, and though cultivated in various media, produced no other form of reproductive organs than the conidia directly inserted in the mycelium, which, on maturity are set free in the usual manner. This parasite, according to the author, belongs undoubtedly to the Mucedineae and includes a genus (*Mauginiella*) and a species (*M. Scaettae*) new to science, described in this preliminary note and of which the respective Latin diagnoses are given. G. T.

373. ***Coryneum* sp., a Melanconiacea injurious to the Japanese Chestnut.**

DUFRENOY J. and GAUDINEAU M. Sur une maladie causée par un *Coryneum* nouveau. *Revue de Pathologie végétale et d'Entomologie agricole*, Vol. XI, Part 2ª, pp. 164-167, Tables 2. Paris, 1924.

In the Department of Ardèche, at Levada, some trees remaining over from a large nursery of Japanese chestnuts, transplanted in their seventh year and now about 25 years old, show longitudinal streaks on the trunk, of a somewhat different colour from that of the rest of the bark, and bearing pustules. These streaks continue above the bifurcations of the larger branches. The smaller branches of these trees are almost all stripped of their leaves, and show here and there clusters of black pustules, almost circular at first, afterwards ellipsoidal, also, there is a swelling of the outside bark.

Sections made in the bark on a level with the pustules reveal the existence of a stroma bearing conidia of a Melanconiacea (*Coryneum*) not specifically determined by the authors, but considered by the them to be new. It is different from the various species of *Coryneum* hirtherto described as parasites of the chestnut, both in Europe and America. G. T.

Animal Enemies.

374. ***Isobremia kiefferi* n. sp., a Dipteron parasitic on Aphides in Jugoslavia.**

VOUKASSOVITC, P. Observations biologiques sur un Diptère, *Isobremia kiefferi* n. sp., parasite des Pucerons. *Comptes rendus des séances de la Société de Biologie et de ses filiales*, Vol. XCII, No. 5, pp. 357-359. Paris, 1925.

The author, who has carried on research work in the laboratory of the Entomological Institute of the University of Belgrade, reports hav-

ing observed the Dipteron *Isobremia kiefferi* n. sp. as a parasite on the rose aphides (*Macrosiphum* [*Aphis*] *rosae* and *M.* [illegible] [*Aphis*] [illegible]), of the aphis of *Sonchus* (*Aphis* [*Macrosiphum*] *sonchi*) and of certain other unspecified aphides.

The genus *Isobremia* Kieff previously contained only one European species, *I. sonchi* Kieff., the larvae of which are external parasites of *Aphis sonchi*.

The female of the new Dipteron lays her eggs on the parts of the plant which have been attacked by the aphides, either close to or actually among them, or even on their bodies. The larvae at once find an aphis and fix upon it, preferably on the ventral side of the thorax but also frequently on the abdomen and in that case also always on the ventral side. The aphis attacked by a larva makes no reaction; it is paralysed or destroyed by the poisons passed into the system by the larva after fixation. The author has frequently been able to observe in nature three or four very small larvae of the Dipteron attached to the same aphis. The dead aphides do not differ as a rule from the healthy, except that the skin appears to be slightly wrinkled.

An account is given of the biological observations made of the later stages of the development of the Dipteron, and the author further states that a certain number of larvae of *I. Kiefferi* were infested by the Hymenopteron *Proctotrupis Synopeas rannis* Walk. the larvae of which are internal parasites. G. T.

375. ***Protapanteles marquesi*** **n. sp., a parasitic Hymenopteron of *Papilio anchisiades capys*, a Lepidopteron injurious to the Orange in Brazil.**

DE AZEVEDO Marques LUIZ, A. Vespa versus lagarta. *Chacaras e Quintaes*, Vol. XXIX, No. 2, pp. 109-110, Table 1. S. Paolo, 1924.

In May, 1923, at Rio de Janeiro, the author found a small hymenopteron which Dr. J. BRÈTHES, to whom he had submitted it for classification recognised and described as a new species under the name of *Protapanteles marquesi*. This, according to the author's observations, is an effective endophagous parasite of the caterpiliar of the Lepidopteron *Papilio anchisiades capys* Hubner, which is very injurious to the orange, and attacks the leaves at various seasons of the year.

The discussion on the new Hymenopteron by Dr. BRÈTHES is given. G. T.

376. ***Metadrepana andersoni*** **n. sp., a Microlepidopteron injurious to Coffee in Kenya.**

TAMS, W. H. T. Description of two new species of the genus *Metadrepana* (*Drepanidae, Lep.*). *Bulletin of Entomological Research*, Vol. XV, Part 3, pp. 289-291, figs. 4. London, 1925.

A description of *Metadrepana andersoni* n. sp., the caterpillars of which, in 1922, in the Colony of Kenya, injured the coffee-plant by stripping it of its leaves.

M. pallida, collected in Northern Nigeria, is also described as a species new to science, but without any indication as to its economic importance. G. T.

377. **The "Potato Moth" (*Phthorimaea operculella*) found on Tobacco, in Brazil** (1).

BURGESS, P. S. (Rhode Island Agricultural Experiment Station). *Soil Science*, Vol. XVIII, No. 3, pp. 169-172. Baltimore, Md., 1924.

During the month of May 1924, the tobacco plantations of the Jaguarayara district were attacked by the "potato moth" (*Phthorimaea operculella* Zell.).

This Microlepidopteron was also observed on tobacco in Bahia and the surrounding district. The author thinks that it may exist throughout the State of Bahia.

In addition to tobacco, *Phth. operculella* has been found on other Solanaceous plants, for instance, the "Jurubeba" (*Solanum paniculatum* L.).

On tobacco the damage caused by the "'Moth" is of relatively small importance, as the larva mostly attacks the lower leaves, which have no economic value, while it is rarely found on leaves 30 centimetres above the soil. In "nurseries" and on newly transplanted seedlings, however, these insects can cause considerable damage.

Investigations carried out in all the Brazilian States, more especially as regards the cultivation of tobacco (potato planting is very limited), will decide whether *Phth. operculella* is an indigenous or an imported species; the results of these studies will indicate the best means of controlling the parasite. G. T.

378. ***Lophyrus similis*, a Hymenopteron reported as Injurious to *Pinus Cembra* in Switzerland.**

BARTHEL C. Un lophyre ravageur du pin cembro (Arolla). *Journal forestier suisse*, Year 75, No. 10, pp. 189-191, table 1. Bern, 1924.

At Pont de Nant-sur-Bex (Canton of Vaud) at a height of 1253 m., well-developed pines, 20 years old and 3-5 metres high, were found on 26 July, 1924, to be partially stripped of their leaves, both the new leaves and those of the previous year, by the *Lophyrus similis* Htg. larvae. This hymenopteron had not previously been observed as a parasite of *Pinus Cembra*.

Other conifers of the *Pinus* and *Piceae Abies* genera, grown in the same locality, remained immune from all attack.

This hymenopteron has not been noticed in other plantations of cembrus in the same valley.

Measures have been taken for the immediate destruction of the insect in the zone invaded. G. T.

(1) See also *R.* Oct.-Dec., 1923, No. 811. (*Éd.*)

571. *Thaumetopoea wilkinsoni* n. sp., a Macrolepidopteron injurious to Pine Trees in Cyprus.

TAMS, W. H. T. A new processionary moth (Notodontidae) injurious to pine trees in Cyprus. *Bulletin of Entomological Research*, Vol. XV, Part 3, pp. 293-294, 3 figs. London, 1925.

The Macrolepidopteron *Thaumetopoea wilkinsoni* which, in its larval state, has caused serious injury to pine trees in Cyprus, is described as a species new to science.

G. T.

CURRENT NOTICES

Legislative and Administrative Measures

380. **Austria : Legislative measures relating to the trade in clover seeds, seeds of timothy grass and flaxseed.** — In certain districts of the Austrian Federation there are laws compelling agriculturists to destroy dodder in the fields (e. g. Law of 2 January 1883 in Lower Austria, *Landesgesetzblatt* N. 3, 1885). These however refer only to the dodder actually observed on the fields, but not to the clover seeds which, as is well known, are often put on the market with an intermixture of the seed of this parasite. The publication of a law against trade frauds (Federal Law of 26 September 1925, *Bundesgesetzblatt für die Republik Oesterreich*, No. 531, 1925) gave the Federal Government the opportunity of regulating by a decree the trade in seeds which were often impure owing to the presence of dodder. The decree came into force on 1 December 1924 and in accordance with its provisions seeds may be put on the market, in quantities larger than half a quintal, only in bags sealed with the seal of the Federal Inspection Bureau, and only bags containing seeds found to be wholly free from dodder may be so sealed. In addition to the seal and the words « Free from Dodder » the place of origin must be plainly marked on the bags with the name of the State belonging to the Federation, together with the words ' Austrian goods '. Seeds for sale in quantities of less than 5 kilogrammes do not come under the regulations as to bagging or as to declaration of place of origin and quality, and thus home grown seeds when not for sale are not bagged or sealed for this purpose.

As regards the quality, seeds are distinguished as follows : (*a*) in the natural state ; (*b*) sifted seed ; (*c*) screenings or siftings : seeds fit for use.

The country of origin must be indicated in the case of seeds from foreign countries. From time to time the bodies empowered to inspect and seal the sacks will be designated, and they are empowered to employ persons sworn for the purpose of taking samples. A tax is payable on the affixing of the seals. The responsibility for the proper execution of the provisions of the decree rests with the district administrative authority and with the Federal Institutions responsible for the sealing of the sacks. (*Bundesgesetzblatt für die Republik Oesterreich* ; No. 64, 13 August 1924).

381. **Legislative measures against diseases and pests of plants grown in Austria.** — The ' Landtag ' of Carinthia has passed a law which

is the first comprehensive enactment of the kind in Austria. In paragraph 1 the law regulates the measures for the control of all plant pests, including weeds, but excluding birds and mammals which come under the game law. The law compels landowners, tenants, holders in usufruct, managers of farms, etc.: (*a*) to use the utmost care to keep their holdings free from noxious insects and disease, using the proper control measures and at the appropriate season whenever possible; (*b*) individually to comply with the regulations laid down by the authorities either for prevention or control, or to take part in collective action for the purpose; (*c*) to assist, by assigning the necessary labour and paying all costs thereof, in the carrying out of a joint scheme of control; (*d*) to notify to the communal authority the appearance of noxious insects, diseases or any suspicious signs of a probable visitation; (*e*) to contribute information to the official enquiries to be made in this connection.

Access must moreover be allowed to the farm, the storehouses, farm buildings, etc., for the necessary official reports and for carrying out the control measures. The communal authorities are responsible for seeing that the farmer complies with the provisions of the law, and in cases of urgency may enforce the application of the proper measures and the assistance of every person in the neighbourhood who is conversant with them.

In case of neglect on the part of the landowner, the Mayor may order the official execution of the necessary operations and at the owner's expense. The communal authority passes on the notices of the appearance of noxious insects or of diseases to the State authority when the commune itself has not the necessary resources for instituting control measures. Joint premiums may be assigned for such measures at the communal expense. The political authority may, in its turn, arrange for the execution of what work is necessary, charging the cost to the commune, in case of non-compliance with the provisions of the law.

The government of Carinthia has the power (*a*) to prescribe in general fixed methods or means of control of noxious insects and plant diseases; (*b*) to order the carrying out of preventive measures; (*c*) to issue special instructions in certain cases; (*d*) to exercize a regular supervision of fish ponds, nursery gardens, florists' depots, etc.; (*e*) to prohibit the sale of plants and trees on the market or by travelling vendors; (*f*) where necessary to declare places referred to under (*d*) as infected, or, as a preventive measure, prohibited.

When joint action is taken for controlling noxious insects and plant diseases, the Government is empowered to supply, the parties concerned with the apparatus necessary for the work on suitable terms, or to meet the consequential expenses by means of a loan. In given cases the Government may grant subsidies, to the extent of available resources, (*a*) for the purchase and distribution on special terms of the apparatus required for control; (*b*) for the purchase of seeds, cuttings or suckers; (*c*) for the payment of premiums; (*d*) for the cost of securing the proper observance of the legislative provisions; (*e*) for compensation to persons who have incurred losses through the carrying out of the control measures.

In accordance with the general provisions made by the authority the measures must be carried out simultaneously and with the utmost care or

the roads, in cemeteries, along dykes, in quarries and factories as on other communal areas, at the expense of the commune and by means of labour provided by it.

The State authorities are also required to work in conjunction with the Agricultural Experiment Stations and with other competent bodies. The president (*Landeshauptmann* of Carinthia) is authorized to issue special instructions for the prophylaxis and control of different diseases. In this connection a series of measures are contained in the order accompanying the law for the extirpation of barberry (*Berberis vulgaris*); for destroying cockchafers so as to check so far as possible the socalled cockchafer season: for the destruction of *cuscuta trifolii*; for reporting the appearance of the apple weevil, clover dodder, black potato scab; for removing caterpillars from fruit-trees, and burning them; for thinning out fruit-trees, scraping the bark, painting with lime, etc. (Law of 25 September 1923 on the control of against plant diseases and pests *Landesgesetzblatt für Kärnten*, No. 6, 11 April 1924; Ordinance 11 April 1924, of the President of Carinthia for giving effect to the preceding law. H.).

382. **Control of Cockchafers (*Melolontha vulgaris*) in the country districts of Lower Austria.** — The appearance of swarms of cockchafers on an alarming scale caused the Government of the province, on the request of the Chamber of Agriculture, to compel the owners of farms, tenants and holders in usufruct to exterminate the beetles and their larvae and to take part in common action for the purpose under the supervision of the Mayor of the place. With a view to making the measures still more effective schoolchildren can be called in to help, working in groups under suitable leadership.

By way of encouraging the children to do their utmost, the Chamber of Agriculture instituted for 1924 a general prize of 200 crowns. (Verordnung des Landeshauptmannes für Niederoesterreich vom 30 April 1924 womit auf Grund des Gesetzes vom 17 mai 1912, *Landesgesetzblatt*, No. 81, betreffend den Schutz des Bodenkultur gegen schädliche Insekten, Durchführungsbestimmungen bezüglich der Maikäferbekampfung erlassen werden. *Landesgezetzblatt* 64, 30 April 1924, Vienna).

383. **Encouragement of Horse Breeding in Lower Austria.** — The Lower Austrian Chamber of Agriculture (*Landeslandwirtschaftkammer*) has undertaken the work of encouraging horse breeding in the province. The Regional Horse Breeding Commission (*Landespferdezuchtkommission*) represents the central body and consists of: (1) two expert representatives of the Chamber of Agriculture; (2) a representative of the Federation of the Lower Austrian Consortia for Horse Breeding; (3) a representative of the Lower Austrian Government; (4) the stud officer of Lower Austria in charge of the government stallions: (5) the Director of the Section of Zootechnics of the Chamber of Agriculture already metioned. A delegate of the Federal Ministry for Agriculture and Forestry is invited to attend every meeting.

The work of the Commission includes: (1) official approval of the stallions; (2) to establish and approve the fixing of districts for breeding each sub race, thus obviating the possibility of the influence of more than one sub race in any one district; (3) to take part in the official approval of stallions at shows, and to supervise the action of District Commissions and Horse-

Breeders' Consortia; (4) to propose the purchase of stallions for service stations offered for the purpose, to fix rates for stallions, etc. and to advise the Chamber of Agriculture (of Lower Austria) in any question relating to horse breeding.

In every district in which it is considered necessary a District Commission for Horse Breeding is appointed, usually at the headquarters of the District Agricultural Chamber, constituted as follows: (1) a chairman; (2) a breeder of high scientific reputation; (3) a veterinary officer who will keep the registers of the Commission.

The duties of the District Commission are: (1) to approve the mares and keep the registers of the approved animals; (2) to refer to the Lower Austrian Chamber of Agriculture all proposals, reports and offers from third parties in respect of any question of horse breeding, more especially in the district and to advise the District Chamber of Agriculture; (3) to organize horse shows and offer prizes: (4) to safeguard the interests of horse breeders; (5) to set up and maintain, with the consent of the Lower Austrian Chamber of Agriculture, institutions and organizations for the encouragement of horse breeding; (6) to give technical advice to horse breeders and to the respective horse breeding organizations and generally to exercise a beneficial control.

For the current year already approved stallions only are admitted to the mounting stations together with the government stallions of the Confederation.

The precise instructions in regard to the approval of stallions are contained in paragraph 14 of the law on horse breeding. Special instructions for methods of judging and for the management of mounting stations are contained in a regulating order for Lower Austria, contained in the *Landesgesetzblatt*, No. 34, of 5 February 1924.

Paragraphs 22-26 contain instructions for the management of a mounting station, including the compilation of the registers, the supply of mounting certificates to the owners of mares, diseases to which stallions are liable, etc. An important provision is that every registered stallion must be inspected once a month by the veterinary officer.

By the terms of paragraph 27 mayors are required to make statistical returns every year on 1 January of all horses in the commune that are suitable for breeding purposes, and to forward the information so obtained to the District Chamber of Agriculture. If it appears that there are in the district at least 25 owners of mares fit to be served a 'Horse Breeding Consortium' may be proposed by the Chamber. Such a Consortium may also be established if required by at least 25 owners of mares. In districts where such a Consortium is already in existence, the District Chamber of Agriculture must summon every year a district meeting to decide on all questions relating to the horse breeding of the district.

Paragraph 28 lays down rules for the annual approval of mares, and it is an important feature that only members of the Consortium or applicants for membership may present their mares for the official approval. The approved mares are noted in the appropriate register, and a certificate is handed to the owner of the animal.

All the Consortia are combined in a Federation. The federated State is responsible for all expenses connected with the official approval of stallions

and mares, except when an owner himself requires that animals newly purchased be approved, in which case he is responsible for the costs.

Fines up to a million crowns are imposed by the district authorities on persons who (1) employ for mounting purposes stallions not approved; (2) have their own mares served by stallions not approved; (3) employ for mounting purposes a stallion of their own belonging to a sub race not authorized by the Lower Austrian Commission for breeding purposes in a given zone; (4) allow stallions of two or more years old to pasture with mares promiscuously.

The following provisions are important: official approval may only be given in the case of stallions which belong to a well defined breed and are not the products of cross breeding. In the case of already approved stallions consideration is given to their capacity for the transmission of hereditary qualities and to the character of their offspring. Further provisions relate to the care, feeding and working of stallions intended for mounting, subsequent disinfection, prophylactic measures, registration, fixing of mounting charges and arrangements for notification to the Lower Austrian Chamber of Agriculture. (Law of 8 March 1923 relating to the promotion of horse-breeding in Lower Austria. *Landesgesetzblatt*, No. 87, 1923: order of 5 February 1924 of the Lower Austrian Government relating to the approval and maintenance of stallions on the basis of the law of 8 March 1923 (*Landesgesetzblatt* Nr. 34, 1924).

384. **Austria. Order in regard to diseases of bees.** — This order has reference to the Austrian Law of 6 August 1909 (*Reichsgesetzblatt* 177) on infectious diseases in animals, and in respect of bees makes compulsory the notification of brood diseases, of the appearance of *Nosema apia* in the epidemic form and of acaries. In any sporadic appearance of these diseases, the mayor must forbid any transport whatever of the hives affected, and must secure the destruction of diseased combs. Should there be a more general outbreak, the veterinary officers and a beekeeping expert must be called in, who if necessary will order the destruction of the bees attacked by the disease and the removal, with due precautions and in the evening, of the respective combs. If the owner of the hive refuses to comply with these orders, he may be compelled to take measures to ensure that the bees do not leave the hive. The infected hives from which the bees have been removed must be burnt or at least cleansed and disinfected as far as possible.

Swarms may not be taken from suspected apiaries, unless they have been asertained to be perfectly healthy. The epidemic is declared to be at an end, when after two months application of all the necessary prophylactic and disinfecting measures it is found that there are no further cases even of suspected disease.

The order concludes with a detailed account of the symptoms and nature of the diseases mentioned.

385. **Protection of the natural features of Lower Austria.** — By a law of 3 July 1924 the preservation of natural features, whether characteristic or unusual, is assured alike on economic, educational and, in respect of the landscape, aesthetic grounds. Since watercourses, lakes, nests of birds of prey, single trees or groups of trees may be declared to be natural features and in this way the right of the respective owners to dispose as they

please of their property is curtailed, the law affects agricultural interests very closely. Thus by paragraph 9 the State authority does not allow owners, tenants or holders in usufruct to modify or destroy the natural features, unless they are of a kind to endanger human life or there is reason to anticipate as the result of neglect or carelessness, any worse result. The owner, tenant or holder in usufruct have the right of appeal to the President of the State (" Landeshauptmann " of Lower Austria) against the refusal to authorize modifications of natural features, and such refusal may moreover only be pronounced after considering the report of the regional Chamber of Agriculture which is the representative of the agricultural interests. Article 10 pronounces it to be the duty of the authorities to take special care to preserve existing natural features, employing every kind of administrative procedure culminating in legislative measures relating to waters, forests, buildings, etc., and even setting aside funds for the purpose. If the demand for the work required does not issue from the owner, but from the special Office for the Preservation of Natural Features, this Office must be responsible for the expenditure.

If the owner of any natural feature does anything to alter or destroy it, he may be compelled to restore it as far as possible to its original state. With the object of preserving the landscape, the consent of the special National Office for the Preservation of Natural Features is required for the clearing of forest, as well as the consent of the competent forestry authority. No rare trees or bushes may be cut down, nor may rare flowers or plants be gathered for commercial purposes, nor rare animals taken or killed. The President of the State (province) may declare districts which are rich in natural features to be reserves, after however obtaining the consent of the respective owners (*Die N. Ö. Landeskulturgesetze*, Vol. 1, Vienna, 1924. Publication of the Lower Austrian Chamber of Agriculture).

386. **Brazil: Permanent Production of Brazilian Coffee.** — By a presidential law of 19 December 1924, having force in the State of San Paulo, an *Istituto Paulista de Defeza permanente do Café* has been set up with the following functions: (1) the grant of loans to persons interested, on terms to be fixed by the Council of the Institute, and on pledge of the coffee stored in the State warehouses; (2) the purchase of coffee in the market of Santos and in any other home market with the object of temporary withdrawal from the markets, provided that the Council consider it necessary for the regulation of supplies; (3) the maintenance of a service of information, statistics and propaganda relating to coffee, for extending sales and checking adulteration (*Revista da Sociedade Rural Brasileira*, year VI, No. 55, 1924).

387. **Brazil: Protection of Sericulture in the State of S. Paulo.** — The Government of the province has enacted a law of the " Congresso Estadoal ", empowering the administrative authorities to agree to protection and propaganda for sericulture in the State of S. Paulo through the agency of the National Silk Industry Limited Liability Company (*Sociedade Anonyma Industrias de Seda Nacional*). (*Brazil-Ferro-Carril*, Year XVI, vol XXVIII, No. 382, 1924).

388. **Chile: Provisions regulating the Sale of Fertilizers.** — Sales must be made on the basis of a chemical analysis. For the purpose

of the law the following are understood to be fertilising elements: phosphorus expressed as soluble anhydride ($O_2 P_5$), nitrogen, potash expressed as ydrate (KOH), calcium expressed as oxide (CaO) or sulphate ($CaSO_4$). For the time being the *Estación Agronómica* attached to the *Servicios agricolas* carries out the analysis of the fertilisers, and regulations will be issued regarding the processes of analysis to be followed, and also specifying other laboratories which may carry out analyses, whether directly or for purposes of control. (*Diario Oficial*, Nos. 14 and 37, 25 Nov. 1924).

389. **Spain: Organization of the Agricultural and Zootechnical Services.** — In accordance with provisions a decree drafted 20 June 1924, the Spanish Agricultural and Forestry Department includes two sections: (A) Agriculture; (B) Forestry. Section A includes in its turn the following branches: (1) agricultural experiment and instruction, provincial service and phytopathology in relation to agriculture; (2) agricultural improvements and stockbreeding. Section B includes, (1) repopulation; (2) upkeep of forests; (3) protection of wooded property, technical instruction and general questions.

Special articles of the decree deal with the following subjects: Council of agricultural science, agricultural hydraulics service, agricultural pests, research and inspection laboratories, phytopathological inspection, inspection and supervision of the trade in fertilizers, the part taken by the expert staff in agricultural social problems and in agricultural experiments, trade in farm machinery, experimental and demonstration plots, diffusion of agricultural information and propaganda, agricultural publications and charts, technical assistance to agriculture, establishment and management of the regional and provincial offices, encouragement of sericulture, a Central Station for Scientific Agriculture, a farm school for the training of farm managers. The establishment of the following stations is also referred to: viticultur, stockbreeding, arboriculture, pomology, rice growing, experimental work in seeds, horticulture and gardening, the agricultural industries, the dairy industry, motorculture, olive cultivation and oil production, plant pathology, sericulture and the rearing of domestic animals, cidermaking, vinedressing and wine making. A special Division for Agricultural Experiment work has been also instituted by means of the special stations which are set up at Almeria, Barcelona, Valencia, Seville and Xeres de la Frontera. (*Gaceta de Madrid*, No. 174, 22 June 1924 and Legislative Texts of the International Institute of Agriculture, No. 28, 1924).

390. **Tobacco Cultivation in Spain.** — An extension till 30 December 1925 has been ordered of the term of three years, fixed by the Regulation 30 December 1910 for the experiments in the cultivation of tobacco, and conditions are laid down which are to be binding on agriculturists who propose to undertake the cultivation of tobacco in the Peninsula or in the Balearic Islands. The total quantity of the plants to be cultivated is fixed at 12 million stocks (2000 as the minimum for each grantee); the seed will be distributed, at preferential rates, by the *Comisión central encargada de los ensayos del cultivo del tabaco en España*. Instructions are also given regarding the plantations, premises suitable for drying the leaves and the packing of the dried leaves. Every kg. of the leaves is paid at the rate of 1 to 2.50 pesetas according to quality. Officials and other experts direct and supervise the cultivation. (*Real*

Orden, 27 October 1924; *Gaceta de Madrid*, 23 October and 1 November 1924).

391. **Measures for Reafforestation in Spain.** — R. D. 20 December 1924 (*Gaceta de Madrid*, 23 December 1924).

392. **Spain: Customs Dues on farm tractors and motors.** — In consequence of representations made by the most important firms dealing in agricultural machinery, the Minister of Finances has ruled: (1) that the Royal Decrees of 19 July 1912 and of 6 May 1921 are declared to be in force, authorising the firms mentioned to import motors and tractors in accordance with provision 37 of the Customs tariff; (2) that proof of the use of these machines for agricultural purposes must be given within two years; (3) that within the following five year period, the purchasers of the machine must present an agricultural engineer's certificate similarly attesting the fact of its use in agriculture; (4) that at the time of importation the dealer must guarantee to pay the difference in the customs dues between the preferential rates for machinery for agricultural purposes and those in force if the machines are put to other purposes. (*Real Orden* 23 October 1924).

393. **Spain: Regulations for Remount Stations for Horses.** — These regulations relate both to the stations already established, and to those to be set up. They were approved by Royal Decree of 26 December 1924 (*Gaceta de Madrid*, 31 December 1924).

394. **Protection of Insectivorous Birds in Spain.** — The value of these birds from the farmer's point of view is recognized and in view of many complaints which have been received from the *Sociedad Protectora de animales y plantas de Cataluña* and from other farmers' associations, an order has been issued, pursuant to the *Ley de Protección* 19 September 1896 and to the International Convention of 19 March 1908, to the effect that the greatest vigilance be exercised to prevent killing in close seasons, etc., and that the dealing in or sale of killed birds together with their transport by railway, is forbidden. (*Real Orden*, 31 October 1924: *Gaceta de Madrid*, 3 November 1924).

395. **Organization of Anti-malarial prophylaxis in Spain.** — A Royal Decree issues instructions under the following heads: declaration of the malarial zones, ad hoc Committees, antimalarial dispensaries, duties of the inhabitants of the infected regions, treatment of malarial waters, dwellings in the marshy areas, prophylactic measures in the large farms, rice cultivation, steeping of textile plants, quinine, rewards and penalties. (*Real Decreto*, 13 December 1924: *Gaceta de Madrid*, 13 December 1924).

396. **France: Encouragement of the use of Nitrogenous Fertilisers.** — A decree has been published in the *Journal Officiel* of 25 December 1924, by the terms of which a premium is granted to agriculturists who purchase sulphate of ammonia and also synthetic nitrogenous fertilisers made in France or imported from Germany as payments in kind. It is however stipulated that such fertilisers are employed by the farmers on the lands they are themselves cultivating or which are cultivated under their direction. The premium is reckoned at the rate of 14 centimes per kg. of nitrogen effectively present in the fertiliser. As regards sulphate of ammonia, the content in nitrogen will however be taken as uniformly 20 %. The subsidy at its highest cannot exceed, in one year and for a single cultivator, 400 francs. The premiums are

limited to the following nitrogenous fertilisers: sulphate of ammonia, ammonium chloride, urea, cyanamide and synthetic nitrates. (*Journal Officiel*, 25 December 1924).

A law was subsequently passed on 26 December 1924, setting aside a sum of five million francs to enable farmers to purchase fertilisers.

397. **France: The Cinema for Agricultural Use.** — By a Decree published in the *Journal Officiel* of 16 November 1924 a permanent Committee of 33 members is set up, which is attached to the Ministry of Agriculture and decides on the grants to be made for the preparation and purchase of films, for the installation and working, in the rural communes and in the institutions for instruction in agriculture, of cinematographic apparatus, whether fixed or travelling, intended for the diffusion of information useful to farmers and for the necessary propaganda.

398. **Algeria: Measures for checking the spread of *Diaspis pentagona* Targ.** — A decree of 11 December 1924 regulates the importation into Algeria of plants coming from Italy. (*International Institute of Agriculture, Legislative Texts*, No. 33).

399. **Great Britain: Annual Agricultural Returns.** — The annual returns of the acreage of crops number of live stock, etc., afford the only reliable evidence of the dimensions of the agricultural industry, and of the changes from year to year. Information on these points is essential to any proper estimate of the economic conditions of agriculture. The *Agricultural Returns Bill* has been re-introduced into Parliament and passed its Second Reading in the House of Commons on 19 February. This Bill will make the furnishing of agricultural returns compulsory, and so give the Ministry the powers to require these returns which it had under the *Corn Production Act* of 1917. The compulsory powers are needed in order to surmount many practical difficulties that would otherwise prevent the collection of the necessary information in proper time. (*Agricultural Market Report*, Vol. XXII, No. 8, 1925.)

400. **Italy: Supervision and Inspection of the Preparation of Silkworm Seed.** — By Ministerial Decree the supervision and control by an inspectorate of the establishments for the preparation of silkworm seeds, already prescribed in the law of 28 June 1923, has been entrusted to the Royal Silkworm rearing Stations of Ascoli Piceno and Padua, who are responsible for control, either directly through their own technical staff, or exceptionally by employing the staff of the Royal Agricultural Schools and of the travelling lectureships in agriculture or individuals who are recognized experts in the subject. The microscopic examination of selected samples of seeds is effected at the Higher Schools of Agriculture at Milan, Perugia, Portici, in accordance with the provisions of art. 12 of the law cited above.

401. **Italy: Order for Higher Instruction in Agriculture and Veterinary Medicine.** — Royal Decree 30 November 1924 (*Gazzetta Ufficiale* No. 10, 14 January 1925).

402. **Japan: Legislation on Agricultural Tenancy Arbitration.** — This includes: Law No. 18, 23 July 1924, on agricultural tenancy arbitration: Imperial order No. 204, 9 September 1924, amending the organization of the Ministry of Agriculture and Commerce. — Imperial Order No. 205, 9 September 1924 amending the Imperial order in the hierarchy and the salaries of

high officials. — Order of 19 September 1924 of the Ministry of Agriculture and Commerce amending the regulations for the division of the Ministry into sections. — Imperial Order No. 214, 17 September 1924 amending the special organization of Hokkaido. — Imperial Order No. 215, 17 September 1924, amending the organization of the provincial officials. — Imperial Order No. 228, 25 September 1924, fixing the date of the application of the law on agricultural tenancy arbitration and defining the territories on which the law is not to be applicable. (*Kwampô* : 22 July, 10, 12, 18, 26 September 1924 and *International Institute of Agriculture, Legislative Texts*, No. 34).

403. Luxemburg : The Luxemburg Chamber of Agriculture. — In the *Memorial du Grand-Duché de Luxembourg* of 3 May 1924 a law is published, setting up vocational Chambers on an elective basis and including Chambers of Agriculture, Crafts, Trade, Private employment and Labour. The Chamber of Agriculture has been set up with the object of founding and, in case of need, of subsidising establishments, institutions, and services of special value to agriculture ; of stimulating activity, giving advice, formulating appeals, and obtaining information and statistics in the shortest possible time. The Chamber has the right of making proposals to the Government which must be taken into consideration and submitted, should occasion arise, to the Chamber of Deputies. The opinion of the Chamber must also be obtained on all laws and Ministerial and Grand-ducal decrees relating to agriculture or viticulture. The Chamber consists of 19 members with full voting powers and 19 substitute members, and five members out of each of these groups must be vinegrowers. In addition there must be two veterinaries, one member of the Government School of Agriculture, and a higher official of the administration of Waters and Forests.

The vinegrowing members form a special permanent Committee. The electorate consists of : (*a*) agriculturists, vinegrowers, stock-breeders, fruit-growers, nursery gardeners, gardeners, who are in active employment ; (*b*) former cultivators who have worked for at least 9 years in the district and have no other calling ; (*c*) agricultural labourers and workers in vineyards who, at the date of the publication of the electoral lists, have been following their occupation for at least two years.

404. Holland : Protection of Plants. — Law establishing provisions for the protection of plants against noxious animals and diseases, in view of the importation and transport of flower bulbs, tubers and dried roots (*Staatsblad van het Koninkrijk de Nederlanden*, No. 362, 1924).

405. Portugal : Re-organization of the Ministry of Agriculture. — Decree of 21 November 1924 (*Diario do Governo*, Series 1, No. 264, 5 November 1924).

406. Portugal : Measures for the Utilization of Waste Lands. — Two decrees closely following on each other (*Diario do Governo*, Series I, No. 117, 20 June 1924) lay down the rules and formalities to be observed for the division, utilization and cultivation of the waste lands, and the Commission of *Fomento Agricola* (Agricultural Development) is charged with the work of encouraging and directing such utilization. As waste lands are to be considered, as regards the past, all lands capable of agricultural or forest cultivation and not so cultivated, nor even broken up within the last seven years ; as regards the future, lands

of which the cultivation has been neglected for five years, and in any case lands which have not been made use of for any purpose of public utility or which are not assigned to any other purpose by any special law. The Commission referred to has power to proceed to expropriation and to appropriation of these waste lands, and to have the necessary land register entries made: and (*a*) either to cultivate them at its own expense, or conjointly with firms or individual undertakings, or (*b*) to sell or let them for cultivation, or (*c*) to divide them into lots or grant them in emphyteusis. The lots granted in emphyteusis will form indivisible and inalienable holdings, and will become the property of the Commission, without any compensation for the holder in emphyteusis, so soon as he or his lawful heirs either cannot or are unwilling to cultivated the lands themselves. The Commission will be empowered, as opportunity offers, to make experiments in agricultural land settlement, and also to establish experimental fields and to make cultivation tests, either on the lands which it will keep for itself, or on those granted to third parties for cultivation. Sale or renting can only take place in respect of persons who offer the necessary guarantees for breaking up in view of cultivation and undertake to put the land to full agricultural use within four years, sowing the first year and cultivating in each of the subsequent years a quarter of the total area.

These two decrees prescribe all the procedure to be followed in applications for division of the lands, expropriations, appropriations, sales, tenancies, agreements for holding in emphyteusis, penalties, etc. etc.

Experiment Stations and Agricultural Instruction.

407. Germany: Experimental Forestry Institute, Giessen. (Upper Hesse). — Herr Jörg SCHLOTTERER, assessor for forests and assistant at the above Institute, has published in *Forstwissenschaftliches Centralblatt* (No. 10, 1924) a comprehensive article on the activities of this Institute in forest studies (*Hessische Forstliche Versuchsanstalt*) during the 40 years of its existence. This historical summary is completed by a bibliography of the more important publications issued by the Institute in the period, which have for the most part appeared in the *Allgemeine Forstjagdzeitung*.

408. Austria: Recent developments of Agricultural Education in Lower Austria. — In Lower Austria there are Agricultural Schools of every kind and grade. In Vienna, which has been for four years an independent State and separate from Lower Austria, there is a higher Agricultural School, which has the power to grant degrees and the graduates of which are entitled to be called Agricultural Engineers. There are besides two intermediate and three lower schools (*Ackerbauschulen*) and two winter seasonal courses. Among special schools there is a higher school of Veterinary Science, an Academy for Brewery in Vienna itself and schools of Oenology and Cider Making of various grades, and as from 1924 a school for training young men in Agricultural co-operation. In the Higher School of Agriculture at Vienna there is a forestry section and one for the technique of crop growing, there are also a course in milking and various feminine occupations, a training school for teachers of household management and courses for the daughters of peasants. In addition to the schools which are provided out of public funds there is also a group of schools

maintained by Associations or private persons. It is a satisfactory feature that the attendance at all these schools is very large, and more particularly that the number of sons of farmers who return to the home farms after having passed through the schools is continually on the increase, in contrast to what happened before, when boys who had passed through the schools and were conscious that they were well educated would not apply for employment on farms but for other posts on the railways or in the Post Office. As in these last few years the demand for education for sons and daughters of farmers has much increased, the schools now in existence are no longer adequate. In particular there are on the small farms boys who are desirous of further education but who have not the time to attend for the whole winter at school nor money to live for so long a time away from home and to pay for board in the places where schools are to be found.

The Lower Austrian Chamber of Agriculture with the intention of meeting these pressing requirements and in agreement with the local Government have organised a series of courses completed in their turn by other quite short courses (one or more days) relating to some special branch of instruction. Such courses are intended, for example for the managers of co-operative dairies (four day's course), or deal with the management of pasture land (eight to fourteen days), with wine making (three to fourteen days), land clearance (one day), wine grafting (one day), vine growing in general (two weeks in spring, three days in summer and five days in autumn), keeping of vine growers books (one day) fruit growing (two to five days) and grafting of fruit trees (one day), tree planting (three weeks in spring, one in summer and one in autumn), fruit growing along the roads (three days), fruit growing for elementary teachers (eight days), preserving of fruit and vegetables for women, dairy industries for daughters of peasants, handling of seeds, control measures against weeds, book-keeping, etc., etc.

All these courses are naturally conducted with due regard to local needs and the interests of those who attend them. As a completely new organisation courses were established in the Autumn of 1924, after experiments in the previous winter with great success. These were arranged to cover four months and intended for the sons and daughters of farmers in 32 places where there had been so far no agricultural schools. The purpose of these courses was not to displace but only to replace the winter courses. Ten to 12 hours of instruction are given weekly on two days or three half days. As a rule no evening instruction is given. The course for men includes business correspondence, arithmetic, natural history, history, agriculture, fruit growing, cattle breeding, cheese making, elements of law and of fiscal requirements, book-keeping, co-operation, and where desirable, the management of Alpine farms, wine growing and sylviculture. The subjects in the womens' courses include citizenship, natural history, dietetics, household management, arithmetic and book-keeping, together with stock breeding and cheese making, vegetable growing, first aid to live stock and hygiene. Besides the lessons, various kinds of practical work are arranged, surveying charts are examined, field visits paid and excursions taken. As regards the scope of the curriculum and the funds for the purpose, instructions are issued by the Lower Austrian Chamber of Agriculture, which also meets the expenditure for teachers' services. In any case admission

is to be confined to at most 30 men and 10 women over 16 years of age, and every student admitted must pay a fee of 100,000 crowns. The expenses of maintenance, lighting, heating, etc., are met by the District Chamber of Agriculture. The regional Chamber of Agriculture exercises the final supervision over the courses. The teachers receive 15,000 crowns for every hour of instruction they give and half that sum for every hour of practical demonstration work. At the end of the course a certificate is granted to the students who show that they have benefited by attendance.

Other useful aids to agricultural instruction are the lectures given on the occasion of the "agricultural week" and "the agricultural sample fair" in connection with the "Vienna Fair". The "agricultural week", which for two years past has been held in May by the Lower Austrian Chamber of Agriculture, is divided into sessions which cover different aspects of agricultural activity. Various questions of immediate importance are also handled in a popular form each day at the Exhibition itself.

Instruction in agriculture is also given to soldiers who are anxious to take up work in the country later, and for this purpose farms are in existence under the special management of military experts in agriculture.

With the object of providing elementary teachers with the opportunity of gaining a fuller grasp of agricultural questions a course is held for rural teachers at Mistelbach, attended in all by 175 schoolmasters.

In order to secure a flow of properly qualified labour to the country, coming if need be from the towns, the "Apprentices" Employment Bureau (*Lehrlingstelle*) was founded in 1920 and taken over by the regional Chamber of Agriculture in 1923. The impulse to this foundation was given by the pamphlet of GESZMANN "Back to the Land" (*Zurück zur Scholle*). The essential qualifications for registration are as follows: the boys should have attended the elementary school, be physically fit and show interest in country life, and must be bound to farmers who board them and initiate them into farm work. In the probationary year the boy receives a small amount of pocket money, his food and a change of clothes and linen. When the year is over he receives some clothes, and in the two following years, a larger sum of money and an outfit. A short examination is held at the end of the apprenticeship, and a certificate is given to each boy.

The boy's employer must pay every month to the Employment Bureau, for the first year 10,000 crowns, for the second, 15,000 crowns, and for the third, 20,000: these payments go to meet the office expenses and the Office is responsible for the supervision of the boys during the whole period.

The results of this institution have been very satisfactory on the whole for farmers, but from October 1923 the number of apprendices has been decreasing which is to be explained by the poor prospects they have of obtaining the better posts.

The various agricultural periodicals naturally give every support and encouragement to the instruction in agriculture in Lower Austria, in particular the *Mitteilungen des Landeswirtschaftskammer in Wien* which from January 1925 is appearing in an enlarged form under the title "Landwirtschaft". ("Bauernbündler" *Mitteilungen der Landes-Landwirtschaftkammer*, 1 Dec. 1924. Vienna: Programm zur Ausgestaltung des ländlichen Fortbildungsschul-

wesens; *Ministry for Public Worship and Education*, Vienna, [illegible]; Publications of the "Landes-Landwirtschaftskammer" of Vienna; GESSMANN, Zurück zur Scholle. Vienna, 1919; Die agrarische Woche der Landwirtschaftskammer, 19-23 May 1924, Vienna, 1924).

[illegible]. **Austria: Demonstration Farms attached to the Vienna Higher School of Agriculture.** — In this school students had until lately no opportunity for visiting farms in company with their lecturers as a regular part of their studies, with the object of gaining a knowledge of farm work and of the conditions under which the various crops are grown. Practical work in the vacations suffers from want of the guidance of theory, as at these times the student is working without his tutor and often without any scientific direction. The Vienna school has accordingly made an arrangement with six farms of varying size and in different localities, including one belonging to Dr. HAINISCH, the president of the Republic, by which the farms are placed at the disposal of the school for demonstration purposes. Other farm holdings, with good agricultural industrial equipment are to be incorporated with the School for the same purpose. The farms remain in the full possession of the owner, who does not receive any remuneration from the School, and are to be used by the School only for the objects stated. They may accordingly be visited at any time and examined in detail by the students under the guidance of their teachers and thus it is possible for them to make a real study of farming methods. Such frequent visits facilitate the preparation at the School of farm maps, statistical tables and graphs, which may be shown, with the help of lantern slides, and discussed profitably before any excursion takes place.

A body of rules are compiled for these farms of which the principal points are as follows: demonstration farms must not be either model nor experimental farms, they must be farms actually working at a profit with the sole object of allowing a closer touch of the School with practical work and of enabling visits to be made by the students to farms which can first be studied in every detail by the teaching staff. These farms must at the same time by their special characteristics which are the outcome of local conditions, be well adapted for the teaching and research work, as well as the practical utilization of the results of the new enquiries. A farm selected for demonstration purposes must not on that account be required to incur any special expenses. The owner must allow both the teaching staff and students accompanied by a lecturer access at all times to all parts of the farm, and also the inspection of the farm books, on the understanding that the cash register is excepted. The School may however, if owners are willing to undertake to show their accounts weekly and thus make perfectly clear their system of book-keeping, declare its readiness to keep the books without charge and to close the account at the end of the year. The owner is not compelled to undertake special crops. On request the staff of the School give him the benefit of all their observations, and supply him with their opinion on technical or economic questions. The owner may, whenever he so wishes, withdraw his farm from the list of those attached to the School and the arrangement may also be cancelled on the death of the owner, or when the farm is sold or let. For its own part the School may demand the dissolution of the agreement.

For carrying out the work involved in this new scheme a special Institute

was set up at the Higher School (*Institut für landwirtschaftliche Demonstrationswirtschaften*), to be used jointly by all the departments, with the function of co-ordinating the various programmes of scientific research and the proper utilization of the demonstration farms, and of effecting and maintaining the connection between them and the Higher School. (W. SEDLMAYR V. Landwirtschaftliche Demonstrationswirtschaften der Hochschule für Bodenkultur. *Wiener landwirtschaftl. Zeitung*, No. 74, No. 6032, 1924, KALLBRUNNER, Demonstrationswirtschaften der Hochschule für Bodenkultur, *Neue Freie Presse*, No. 21681 : 1925.)

410. **Brazil : Experimental Cultivation of Wheat in the "Patronatos Agricolas" of Rio Grande do Sul.** — The Director of the Patronato Agricola (Farm Settlement) known as " Visconde de Craca " in Rio Grande do Sul, has forwarded to the Minister of Agriculture samples of American wheat, variety " 448 " and " 142 " cultivated on the Estate experimentally. These varieties originally came from the Experiment Stations of " Estanzuela " in Uruguay and " Ponta Grossa " in Paraguay ; they were sown on 24 June and reaped from 10 to 15 December of the past year, and gave excellent crops.

On the same *Patronato* very satisfactory experiments were carried out in the cultivation of white oats. (*Brasil-Ferro-Carril* : No. XVI, Vol. XXVIII, No. 382, 1925).

411. **Brazil : Experiment Stations for Cotton Growing in the State of Sergipe.** — The Government of this State is continuing the organization of the Cotton Service, five experiment stations having been already installed, situated respectively in the capital and in the communes of Dores, Propria, Estancia and Sao Paulo. On these stations' Day's pedigree cotton which is derived from " Russell Big Boll ", has been planted on a large scale. Experiments have also been made with other varieties, especially in the Central Station, and there are thus under observation specimens both of American and Brazilian cotton. In the station in the capital, which is also the headquarters of the Service, there is a machine plant driven by electric power. Special attention is paid to the grading of the fibre, and the Government of Sergipe requires that all cotton grown in the State and passing into the warehouses shall be graded by the staff of the Cotton Service. Twenty five thousand bales (of 60 to 70 kg.) of the 1923 crop were so graded, that is about 54 % of the total production. The main warehouses are at Aracaju, Larajeira, Riachuelo and Maroim. (*Brazil-Ferro-Carril*, year XVI, Vol. XXVIII, No. 379, 1924).

412. **Denmark : The Botanic Garden, Copenhagen.** — Prof. OSTENFELD has prepared, as a jubilee publication in commemoration of the fiftieth anniversary of the foundation of this Danish institution (1874-1924), an account of the history and resources of the Botanic Garden, Copenhagen.

The present garden is the successor of one that dated back to the close of the eighteenth century and had become inadequate. In 1874 about twenty-four acres were transformed to meet new requirements. In recent years the trees have been collected into a special arboretum at Sorö, and space for special sections was thus provided. The extensive glasshouses in a compact block of more than 2000 square metres include the higher palm-houses and lower ranges where tropical plants, orchids, aquatics and other groups are housed. The Museum contains a mass of material, including special Danish, Arctic, and West

Indian collections. The library of 25,000 volumes has been enriched by numerous donations.

During the past fifty years the garden has been directed by Joh. LANGE, F. DIDRICHSEN, E. WARMING (1885-1911), and C. RAUNKIAER, who was succeeded last year by C. HANSEN OSTENFELD. The staff lists include such well known botanists as W. JOHANNSEN, L. KOLDERUP, ROSENVINGE, F. BORGESEN and many others. Copenhagen has many advantages as a centre for the study of the northern flora, and the monograph of Prof. Ostenfeld, with its abundant information and illustrations, will prove a useful book of reference. (C. H. OSTENFELD, Botanisk Have gennem 50 Aar 1874-1924, pp. 101. Copenhagen, 1924 : *Nature*, Vol. 115, No. 2884, 1925).

413. **Denmark : Competition of the Danish and Icelandic Fishing Industries.** — The Section of Technical Chemistry of the *Polyteknisk Lærenstalt* in Copenhagen has announced a prize competition, intended to encourage the discovery of new and improved technical methods for the utilization of products of the fishing industry in Denmark and Iceland. The prize is fixed at 4,000 crowns and exhibits for competition may be sent to the Danish Polytechnic not later than 1 November 1926 (*Chemiker Zeitung*, year 48, No. 149, 1924).

414. **Spain : Intensive Course in Viticulture at Pamplona.** — This short course was held from 12 to 13 January 1925 at the School for foremen and managers in vine-growing and wine making at Pamplona, accompanied by tests in pruning and vine grafting. The lectures and practical exercises dealt withs the following subjects : (1) land for plantations, American vines, grafts, grapes, must ; (2) trade analysis of wine, elements to be determined in the analyses sample taking, preliminary operations, simple testing or organoleptic examination, microscopic examination, products required in the cellar, preparation of the solutions ; (3) the cellar and its equipment, necessary cleansing and preparation, vats for fermentation, their size, fermentation of the must, stripping of the grapes, ferments, conditions for fermentation, slow fermentation, preservation of the wine, description and causes of diseases and treatment, special operations ; (4) defects and diseases of wine, description and causes of diseases and treatment ; wine tasting, utilization of the residues of wine-making, distillation, alcohols, brandy and liquors, tartar, the more usual adulterations of wine and their recognition, oenological legislation, legal procedure in regard to the wine-making industry ; (5) correction of wine, blending and questions relating thereto ; graphic solution of such problems, fine red wines, special white wines, sparkling wines, sweet wines and liquors, "mistelas", tonic wines.

Each of these five lectures was followed by practical laboratory and field exercises.

The first, third and fifth lecture, besides others on wine grafting and pruning, were given by the agricultural expert N. G. DE LOS SALMONES, Director of the School ; the second and fourth by Professor F. J. CUENDE. Practical work is under the supervision of Professor D. A. GARCIA, late of the Station of Wine-growing and Oenology. Certificates of attendance at the course are granted to students. (*El Progreso agricola y Pecuario*, Year XXXI, No. 1374, 1925).

415. **United States : The Boyce Thompson Institute for Plant-Research, Yonkers, N. Y.** — This Institute was founded by the mining engineer, Colonel WILLIAM BOYCE THOMPSON, and was opened at the end of September

1924. It is to form as it were a universe in miniature for the plants under experiment, in which the environment with which nature supplies plants will be the result of art and these environmental conditions will be regulated by botanists and physiologists by means of elaborate machinery. Thus, since plants respond to changes in temperature, automatic services control the temperature in the rooms and greenhouses : since plants behave differently under different intensities and colours of light, and with differing lengths of day, the light of the sun will be modified or replaced by colour screens and large groups of thousand-watt lamps ; plants must have carbon dioxide from the air, and generators make it possible to supply this gas in any concentration desired, etc. The Boyce Thompson Institute is the result of co-operation between many students and technicians. A kind of Consultative Committee is composed of Prof. J. M. COULTER, head of the Botany Department of the University of Chicago ; Prof. L. R. JONES, head of the Department of Plant Pathology at the University of Wisconsin, Dr. R. F. BACON, formerly Director of the Mellon Institute of Industrial Research. The active head of the Institute and director of research is Dr. W. CROCKER, formerly in charge of Plant Physiology at the University of Chicago. (*Science*, N. S., Vol. LX, No. 1553, 1924).

416. **United States : An Important Bequest for Research in Agricultural Chemistry.** — The entire fortune of five million dollars, which belonged to the widow of HERMAN FRASCH who died 24 September 1924, at Paris, has been left for research work in agricultural chemistry, in fulfilment of the wishes of the testator FRASCH, who expressed in his will the hope that results of real practical utility would accrue. The United States Trust Company, which is executor for the bequest, will propose for this foundation, by arrangement with the *American Chemical Society*, one or several of the institutions of the United States.

417. **France : Popular Courses in Agriculture at Paris.** — These courses are given in connection with the *Conservatoire des Arts et Métiers*. The syllabus is in two parts, as follows :

1. Agriculture and general biology ; 2. Special agriculture and biology. In the first section the following subjects are developed : (*a*) *agrotechnology* (agricultural soil science, biological foundations of agricultural science) ; (*b*) *general phytotechnology* (plant nutrition in relation to agriculture, biological explanations of cultural practice) ; (*c*) *general zootechnology* (animal nutrition in relation to breeding, feeding of live stock, production of milk and of meat).

In the second section the following subjects are treated : (*a*) *phytotechnology as applied to industry* (industrial plants, including the most important colonial species, together with a study of the production connected with each : textile, oil-yielding and resinous plants, plants yielding tannin, perfumes, rubber and essences) : (*b*) *zootechnology* applied to industry (animals yielding silk, silks, production of wool).

The leading principles of agricultural mechanics are taught during the study of practical cultivation and of the special kinds of cultivation. The lectures given in the lecture theatre are supplemented by practical lessons, laboratory demonstrations and practice, excursions, etc.

418. **France : Farm School for the Re-education of Disabled Men.** — This school was established some years ago by the municipality of Nantes, at

Chateau-Thebaud (Loire inferieure), and continues to take in without charge disabled men of all classes who wish to build up a position in the country. It is especially intended for those suffering from lung wounds or gassing, for whom an open air life is beneficial or essential. The course fits them for posts as farm managers, foremen, gardeners, watchmen, shepherds, poultry-keepers, farmers, and breeders of farmyard animals. Daily practical work on the farm is arranged in addition to the courses held in agriculture and stock-breeding. The course lasts for one year, and a certificate of proficiency is given to students who benefit by the course. (*Journal d'agriculture pratique*, year 88, No. 41, 1924).

419. **France: Agricultural School for Girls at Belleville.** — This school was founded in 1919 by Mlle. Thome who bought for the purpose a very large property known in the district by the name of Chateau de Belleville and situated in the valley of Chevreuse (commune of Gomet le Châtel, Seine et Oise). It includes large and well equipped buildings, a model farm, a dairy, a number of farm animals, a large park, an orchard and about 25 hectares of land used for field crops. Girls are admitted from the age of 17. The complete course lasts 10 months and includes: household management, general hygiene, agriculture, horticulture and gardening, arboriculture, stock-breeding, dairying, poultry-keeping, bee-keeping, rural economy ordinary and agricultural law. Professors of the schools of Grignon, Alfort, of the *Institut agronomique* and of various others visit regularly each week to give lessons in theory, followed by practical applications, while the resident professors are responsible for the proper performance of the work whether in the farmhouse, on the farm or in the garden, in which the students take part during the intervals between the courses. During the year visits are organized to model farms, to shows and to large establishments.

The advantages of this valuable institution are extended by Mlle. Thome to girls who are war orphans who are selected from the age of 13 and receive a two years training course in domestic and farm work. (S. MOTTET L'école féminine d'agriculture de Belleville. *La vie agricole et rurale*, Year 14, Vol. XXVI, No. 3, 1925.)

420. **France: Technical Courses in Butchery at Angers.** — These have been established to give technical instruction to workmen and apprentices in the butchery trade. They last three years and deal with theory as well as practice. They offer a complete scheme of instruction and cover all technical questions connected with butchering and the sale of meat (*Journal de la Boucherie* quoted in the "*Revue générale du froid*", year 5, No. 12, 1924-25).

421. **Great Britain: Report of the Colonial Research Committee for 1923.** — The Report draws attention to the geological investigations in the Leeward and Windward Islands; to the researches on the Panama disease of bananas; the re-discovery of deposits of tin in British Honduras, which were known to the Spaniards but have been forgotten. In Nyasaland the investigation of the Sumbu coalfield has given encouraging results; a steam trial with a large tractor was entirely successful; the area of the coalfield is estimated at [illegible] sq. miles. The investigation of sponges in the Bahamas has disclosed the breeding seasons of six types known to the sponge market. (*Tropical Agriculture*, Vol. 1, No. 11, p. 173. Trinidad, 1924.)

422. **Great Britain: The Imperial College of Tropical Agriculture.** — The College was opened two years ago to train students intending to become tropical planters, agricultural administrators or officers or specialists in tropical agriculture. An important feature of the College is the provision for research and investigation. The experimental laboratories and plots are situated at St. Augustine, seven miles from Port-of-Spain in the Island of Trinidad. There are seven professors of zoology and entomology, mycology and bacteriology, botany and genetics, chemistry and soil science, agriculture, economics, and sugar technology, and four lecturers, including one in veterinary science. The ordinary diploma course covers three years. Fourth year courses are provided for specialization in branches of agricultural science or chemical technology, in particular in sugar technology. (*Nature*, Vol. 115, No. 2884, 1925).

423. **British India: Agricultural Experiment Institute at Indore, Central India.** — This Institute was inaugurated on 24 November 1924, and special attention will be given to the growing of cotton. The foundation of this Institute was made possible by the grant by the Indore Durbar of a holding of 300 acres and the grant by the *Indian Central Cotton Committee* of two *laks* of rupees (about £ 15,000 sterling) for the expenses of establishment, in addition to an annual contribution of 120,800 rupees (more than £ 9000 sterling) for the current expenses, there being also a certain return from the land itself. The payment of the annual contribution will be divided between the *Indian Central Cotton Committee* and the eight states of Central India.

The direction of the Institute is entrusted to a body of six members under the presidency of the delegate of the Governor General of Central India. Among these members are nominees from the *Indian Central Cotton Committee*, one of the State of Indore and two of the other contributing States (Dhar, Jacra, Datia, Rutlan, Dewas, Senior Branch, Narsingharh and Sitaman).

The Director of the Institute will act as agricultural adviser to the above named States. The experimental area, granted by the Durbar of Indore to the Institute for 99 years, includes all the varieties of soil that are suitable for growing cotton and which are to be found in India, and is very favourably situated for research work on the cultivation of this plant. It is close to the City of Indore, which is rapidly developing at present as a commercial, industrial and intellectual centre. The Institute will have to form a library so as to be kept up to date as regards the agricultural production of the region, and will be expected to train students who have taken their degrees elsewhere and have been selected by the *Indian Cetral Cotton Committee*. As director there has been appointed Mr. A. HOWARD C. I. E., who has already filled the post of *Imperial Economic Botanist* to the Institute of Agricultural Research at Pusa and the wife of the Director is to be the *Physiological Botanist*, having previously held the position of Second Imperial Economic Botanist at Pusa (Communication received at the International Institute of Agriculture).

424. **Experimental Work in Agriculture in Tanganyika Territory.** — The attention of the Agricultural Department of the Territory continues to be mainly devoted to cotton, in which a gratifying increase in production has been shown. Special attention has been given to the development of the native coffee industry in the Moshi District and to the introduction of ploughing

among the cattle-owning natives in the Shinyanga sub-district of Tabora. The long-established custom in this district had been hand-cultivation by women, but the tribal organisation of the natives lent itself very readily to an organisation of cotton cultivation by communities, the contributory factors being a closely settled population with marked pastoral and agricultural aptitudes, a docile and hardy type of cattle, and large tracts of fertile open soil free from tsetse fly. A station was established for the training of oxen, the instruction of natives in ploughing, as well as for demonstration and the testing of different types of ploughs. Twenty-five ploughs were purchased and issued to native villages which are to repay the cost from the proceeds of the communal crop sold on markets conducted by the Department over a period of two years. The result was the ploughing of 500 acres of land which were under cotton in 1924, and a request by the council of native chiefs for the supply of 320 additional ploughs, on the same terms of repayment.

Other activities of the Department have been concerned with the general agriculture of the Territory, including experimental work at its stations.

The Botanic Gardens at Dar es Salaam have been reorganized, and large consignments of seeds and planting material have been received from botanical stations outside the Territory. An experimental fruit orchard has been established including many Hawaiian and local varieties of tropical fruits. (*Department of Agriculture, Tanganyika Territory, Report for the Fifteen Months ending March 31st* 1924 : 36 pp. in 4°, London, 1924).

425. **West Indies: Sugar Cane Experiments at Ste. Madeleine, Trinidad.** — The Ste. Madeleine sugar company has issued its first report, for the year 1923-1924. The report consists of two parts: (1) Experiments with varieties of sugar-cane; (2) Manurial experiments with sugar-cane. The investigations are being carried out on useful lines and those in charge are to be commended on the start made to solve field problems. (*Tropical Agriculture*, Vol. 1, No. 11. Trinidad, 1924).

426. **Rubber Research in Malaya.** — The Secretary of State for the British Colonies has sanctioned the establishment in Malaya of a Rubber Research Institute, to co-ordinate and extend the work hitherto carried out by the Rubber Grower's Association, private estates and the Government Agricultural Department. The work of the Institute will be guided by its own board of directors. (*India Rubber Journal*, Vol. LXIX, No. 2, London, 1925).

427. **Italy: The Largest Ear of Wheat Grown.** — On the suggestion of the Bacteriological Experiment Station at Crema, there has been recently formed a National Committee of Propaganda for Improving the Cultivation of Wheat (*Comitato Nazionale di azione e propaganda per migliorare la coltura del Frumento*). In the present year 30 hectares of land have already been cultivated experimentally for this purpose and the wheat has been transplanted, after sowing in the seedbed, the plants planted 50 cm. apart and given plenty of fertiliser. Very satisfactory results have been obtained in the competition announced by the Crema Station last year for the largest ear of wheat and the largest wheat plant in Italy, and the Committee hope to obtain still better results. Professor A. VIVENZA, Director of the Royal Higher Agricultural Institute at Perugia is said to have raised a plant containing 341 ears. (*Comitato Nazionale Coltura del frumento*. Milan, 1925).

428. **Formation of Special Administrative Committees for the Royal Agricultural Stations in Italy.** — Special Committees are placed in charge of the administrative side of these Experiment Institutes. No change is made in their composition as regards the provisions already fixed by the various foundation decrees or the regulations. This applies to the Royal Stations for the cultivation of citrus and other fruits (Acireale), silkworm breading and the cultivation of mulberry trees (Ascoli-Piceno), experimental agriculture (Modena), experimental silkworm breeding (Padua), experimental cereal cultivation (Rieti), experimental sugar beet growing (Rovigo), the laboratory of cryptogamic botany at Pavia and the Royal Station of experimental agricultural chemistry at Turin. By the Royal Decree of 28 August 1924, however, a constitution was proposed for the Administrative Committees of the Royal Experimental Oenological Station at Asti, of the Royal Station of Agricultural Entomology at Florence, of the Royal Station of Vegetable Pathology at Rome and of the Royal Station of Experimental Agricultural Chemistry at Rome. (*Gazzetta Ufficiale*, 4 December 1924).

429. **Italy: Courses for Rural Mechanics at Rome.** — On 2 April 1925 there was inaugurated at Rome (at Capannelle) by the Ministry of National Economy with the support of the *Opera nazionale per i combattenti*, a three months course for rural mechanics, intended to train workmen skilled in handling and repairing farm traction and stationary machines. The course is divided into three periods. In the first period of 15 days lessons are given on the elements of physics and mechanics and on the technology of machines (the lathe, the drill, the polishing wheel, welding iron), and practical instruction is given (adjustments, forging of parts, turning, tin soldering and autogenous welding). In the second period of 45 days instruction is given in the elements of agricultural science in connection with the functions, use and output of agricultural machinery, the economic advantages and the selection of machines, the construction and working of the various types of machines for cultivation (ploughs, harrows, etc.). On the practical side the students learn the working of the machines, the mounting, unmounting and exchange of parts, use of speed registers and repairs. In the third period of a month, the theoretical part of the course deals with the farm motor tractor, and the practical work consists in the use and keeping in repair of the tractor and in ploughing exercises and practice in coupling the tractors and working with farm machinery, both stationary and mobile.

Further information on the school may be obtained from the *Opera Nazionale per i Combattenti, Sezione economico-sociale*, Via Ulpiano, 11, Rome.

430. **Japan: Forestry Instruction.** — The Japanese have brought to a high pitch of perfection the professional training of technical experts for the work of managing the State forests. At the present time, the number of Japanese forestry officers is about 2,700, of whom more than 500 are university graduates. The first institution for higher instruction in sylviculture was opened at Komaba, five kilometres from Tokio, in 1881, and in [illegible] it was affiliated to the University. There is a large teaching staff, and the forestry subjects proper are in the hands of six professors. The School has the entire management of a vast forest estate of 100,000 hectares which extends through the whole of Japanese territory and is eminently suited for the practical

training of the students, while forestry engineers, after completing the theoretical course, must work on these forests for three months.

Other forestry schools have recently been opened and also attached to a University; viz. in 1907 one at Sapporo for the Yeso, in 1922 one at Kiusiu, and in 1924 one at Kioto. In addition to these four institutes for higher instruction, Japan has six Forestry Academies. The Government assists professors and students by grants of funds for further training in other countries. Nearly 350 professors are at the present time making use of these facilities.

The Japanese Government has also established a station for forestry experiments, which has been at work for some time at Tokio and to which two sub-stations have recently been added, at Sendai and at Kumamoto. The enquiries carried out by these institutes relate to: (*a*) Re-afforestation and soil investigation; (*b*) utilization of forest products; (*c*) maintenance of forests; (*d*) protection of forests; (*e*) forestry meteorology; (*f*) questions of forest pasturages; (*g*) forest sowing.

The results of the numerous experiments already made by the Tokio station have appeared in a Japanese periodical in English with the title "Journal of the Forest Experiment Station". (*Journal Forestier Suisse*, Year 75, Nos. 7-8, 1924).

431. **Paraguay: Foundation of an Agricultural and Stock-breeding School in Paraguay.** — The establishment of this School was authorized by a law of 11 September 1924, and its headquarters are to be at the Paraguayan Botanic Garden (*Diario Oficial*, No. 1958, 18 September 1924).

432. **Sumatra: The General Experiment Station of the General Association of Rubber Planters of the East Coast of Sumatra.** — In the Proceedings the Experiment Station of this Association, No. 18 of the General Series, a report is published by the Director of the Station, Dr A. W. K. DE JONG on the work of the Station for the period 1 July 1923 to 30 June 1924. The Station consists of an administrative office, three sections, of chemistry, botany and agricultural science respectively and the Experimental Garden of Soengei Pantjoor has been attached. The report contains various chapters referring in order to the various branches of the work of the Station. With regard to the Chemical Section, under MM. H. N. BLOMMENDAL and W. BERTELS, the figures show the amount of work done in the period. In all 1307 different specimens were examined and analysed, including rubber, latex, bisulphate of soda, anticoagulants, derivatives of coal-tar, palm oil, water, soils etc. The Botanic Section under Dr. C. HEUSSER is mainly interested in the selection of varieties of Hevea and phytopathological questions, while the Section of Agricultural Science, under MM. I. A. MAAS and I. F. SCHMOLE, besides dealing with Hevea and the oil-yielding palms, carries out experiments on tea, coffee, forage plants, fertilizers, plants yielding essences, etc. (Verslag van den Directeur van het Algemeen Proefstation der A.V.R.O.S., 1 July 1923-30 June 1924. *Mededeel. v. h. algem. Proefst. der A.V.R.O.S.* General Series, No. 18: 15 pp., 2 tables, Printed by Deli courant. Medan, 1924).

433. **Switzerland: Swiss Experimental Institute for fruit-growing, vine-growing and horticulture in Wädenswil.** — The Director of the Institute, Prof. Dr H. MULLER, THURGAU, has arranged for the publication of a detailed report on the work of the Institute for the initial period

1921-23. In addition to the general summary there are separate chapters dealing with the work accomplished by the Section of Physiology and Vegetable Pathology, the Section of the Bacteriology and Physiology of Fermentation, the Chemical Section and the Technical Section. The latter Section deals respectively with vine-growing, pomology and horticulture. The report contains a considerable amount of information and statistical matter which together with the large number of special courses held by the Institute and the publications of the scientific staff are evidence of the very marked activity displayed by the Institute in the period under consideration. (Bericht der Schweizerischen Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil für die Jahre 1921-1923. *Landwirtschaftliches Jahrbuch der Schweiz*, Year 38. Part 5: 1924).

434. **Federal Station of Viticultural Experiments in Lausanne and the Pully Estate.** — The work of this Station is described in a report by the Director, Dr. H. FAEST and his Assistant M. P. TONDUZ under the following heads: (*a*) the Division of Physiology and Vegetable Pathology; (*b*) the Division of Chemistry and Bacteriology; (*c*) the Secretariate; (*d*) the Pully Estate. As regards division (*a*) reference is made to grafts and grafting stocks of vines, hybrid direct producers, and work on vines with black grapes: this work is done in collaboration with the Viticultural Station at Mezzana, since these wines are the type specially recommended for the Ticino region. The activity of this Division is also displayed in the control measures and the experimental work undertaken in respect of the various diseases of wines and the diseases or parasites of fruit frees, thus carrying on the pomological work of the former Waldensian Cantonal Station.

The Division of Chemistry and Bacteriology has been very active on behalf of the service of information, having carried out at its request altogether 345 analyses of damaged wines and ciders. A large number of analyses were made in connection with waldensian wines of the 1922 vintage, some, for purposes of special studies, on the must of grafting stocks (358 analyses in 1923), 305 on soils, on wines coming direct from the producer, on materials used in wine-making, on Ticino wines, sprays and insecticides, etc. The Bacteriological Section has continued its investigations into the diseases of wines and ciders, has undertaken experiments for the destruction of bats and rats, and in collaboration with the Division of Plant Physiology and Pathology has made a study of the action of benzoate of soda as an antiseptic, etc. In addition, as regards laboratory and technical work the staff of the Chemical and Bacteriological Division have devoted considerable time to the establishment and carrying out of short courses in wine-making, reparation of alcohol free wines, utilization of fruit, handling of the vintage and cider-making.

The report also deals in a special chapter with the research work undertaken on the Pully Estate. (*Annuaire agricole de la Suisse*. Year 25, Part 1, 1924.)

435. **Switzerland: Federal Experimental Seed Testing Institute in Lausanne, Monte Calme.** — A report on the work of this Institute in 1923 has been published by the Director, Dr. G. MARTINET. The number of analyses undertaken was 4,391 besides 703 carried out in connection with the work of the Association of Seed Testers in Switzerland [illegible] seed selection. The Association of Seed Testers in Switzerland [illegible]

suisse des sélectionneurs, Syndicats des sélectionneurs fribourgeois de Sarine, Glâne et Broye, Syndicats des sélectionneurs du Jura Bernois) and the *Bureau des semences d'élite* have had 110 500 kg. of seed in all tested by the Institute. The report gives a considerable amount of information for the work of selection both in the experimental field and in the case of cereal seeds forage crops and other food plants on the farms themselves. There are also notices of tests carried out with various fungicides ("Uspulun" "Fertilisa de Pien-Gan") and powdered carbonate of copper and of tests carried out to check rot in wheat, etc. The Institute has also established a close and valuable cooperation with farmers for the cultivation of potatoes with a view to selection. (*Annuaire agricole de la Suisse*, Year 25, part 5, 1924).

436. **Federal Institute for Agricultural Chemistry at Lausanne.** — An account of the work of this Institute during the years 1922-23 has been published by the chief officer, M. C. DUSSERRE, The number of specimens received and analysed was in all 5585; 2340 in 1922, and 3245 in 1923, and as the number in 1921 was 2200, there has been a progressive increase in the testing work following on the increased quantity of the material in use, which in its turn reached and even in the case of certain substances exceeded the pre-war quantities. The quantity of samples of fertilizers was in all 16 046 100 kg. for 1922 and 24 716 700 kg. for 1923, and the increase was particularly marked in the case of the phosphatic fertilisers. As regards forage crops the number of specimens received during the two years were respectively 368 an 416 for an amount in each case of 1 600 500 kg. and 1 794 300 kg. The report contains valuable notes on the various tests carried out on these substances and on crop specimens, spraying materials, and soils. A note is given on experiments in weed destruction the use of "Phosphazote" for selected cereals and of nitrogenous fertilizers for potatoes as well as of fertilizing material for meadows and pastures. A special report is promised on the fertilizer tests carried out in the *Cressettes* experimental field. (*Annuaire agricole de la Suisse* Year 25, part 30, 1924).

437. **Courses in Agricultural Book-keeping at Brugg, Aargau.** — Three day courses have been held in Germany and in France in February of this year. Students receive board and lodging free of charge and railway travelling expenses are refunded. In return they undertake to keep the accounts of their farm for at least a year under the supervision and direction of the *Secrétariat des paysans suisses*, and at the end of the year to submit their farm books to the Secretariat. Boys working under the orders of the head of the family are not admitted to the courses, unless the head of the family has made them thoroughly acquainted with all the work of the farm and in particular with the details of the accounts. Candidates must have secured the co-operation of the farm housewife as account must be taken of the produce consumed by the family; tenants are not to be taken into consideration, unless they are in a position to supply an exact account of the value of the land, buildings, etc. The secretariate pledges itself not to disclose the name under which the accounts are kept. Diplomas and prizes are awarded to those who show the best account books. (*L'industrie laitière suisse* Year 6, No. 1, Brugg, 1924).

438. **Czechoslovakia: Agricultural Instruction.** — An official publication of the Czechoslovakian Ministry of Agriculture supplies the following

pupils and 301 popular agricultural schools with 14,117 pupils. In addition the farmers' organizations are responsible for the establishment of the rural popular University, the agricultural Museum, the organization of agricultural shows, etc. The administration of the schools of intermediate and lower grade rests with the Ministry of Agriculture. (*Publication du Ministère de l'Agriculture de la République Tchécoslovaque*, 1 August, 1924.

439. **Czecoslovakia: Agricultural Academy.** — The institution has been recently founded at Prague, on the initiative of Prof. STOKLASA, for the purpose of encouraging scientific experiment in the field of agriculture, forestry and the agricultural chemical industry. It is divided into six sections. At the present time the Minister of Agriculture, Dr. MILAN HODZA, is the president of the Academy, and Prof. STOKLASA was elected first Vice-President and M. M. SONNTAG, former Minister of Agriculture and a large landowner, is the second Vice-President, while Dr. REICH has been appointed General Secretary. The Academy, is well supplied with funds and will thus be able at once to enter upon its programme of scientific work.

Agricultural and Scientific Institutions and Associations.

440. **Netherlands: International Comittee of Phytopathology and Economic Entomology.** — The Report of the Secretary, Herr T. A. C. SCHROEVRS, on the work of the Committee for the period 30 June 1923 to 1 January 1925 has now been issued. The Committee was formed on the occasion of the First International Conference on Phytopathology and Economic Entomology, held in Holland in 1923 (see *International Review of the Science and Prac tice of Agriculture*, Vol. II, 1924, No. 1, 288), with headquarters at Wageningen (Holland), Nassauweg 28.

After printing the report of the Conference the question of the practical application of the resolutions adopted arose. After arranging the necessary preliminaries two meetings of the international Committee were held under the presidency of Prof. H. M. QUANJER. At the first, which took place in Brussels on 27 May 1924, a preliminary discussion as to the date and place of the next conference, took place, and also on the relations to be established between the International Committee and the International Institute of Agriculture. The following subjects were also discussed: the enlargement of the Committee by the inclusion of representatives of Russia, South America and China; plans for the collection of the funds required by the Committee in view of the preparation and organization of Congresses; the addition to be made to the funds for the Eriksson prize, intended for the assistance of deserving students, in carrying on experimental work in plant diseases and insect pests; the collection of information and publication of documents referring to phytopathology and economic entomology, etc.

M. LOUIS-DOP, Vice-President of the International Institute of Agriculture and Delegate of France and the French Colonies, was present in an unofficial capacity at the second meeting of the Committee, held in Paris on 9 October 1924. Both M. DOP and Dr. J. H. van RIJN, Delegate of Holland at the International Institute of Agriculture took an active part in the work of that Committee, and the Paris meeting was concluded by a resolution to the effect

data in respect of agricultural instruction during the scholastic year [illegible]: there were three higher schools of Agriculture with 1242 students, two schools of forestry with 181 students, [illegible] agricultural intermediate schools with [illegible] that arrangements were to be made with the International Institute of Agriculture, in accordance with the terms of Resolution 15 of the Seventh General Assembly of the Institute, for the organization of the Second International Conference on Phytopathology and Economic Entomology at Rome in 1925.

In view of new proposals made shortly after the meeting, the President and the Secretary of the Wageningen Committee, in considering the position in January 1925, decided to approach the Government of Czechoslovakia with the request that it would undertake in 1927 the work of organizing the Congress which the Czechoslovakian Republic had originally offered to welcome in 1926. This Congress is to be held in co-operation with the International Institute of Agriculture and with the International Association of Institutions for Plant Protection, provided that the proposals of the President and the Secretary of the Wageningen Committee, regarding the constitution of the Association are accepted. Draft rules for this Association form a part of the report to which reference is here made.

If this Association is formed and officially recognised by the International Institute of Agriculture, the President and Secretary of the International Committee propose that the first general assembly of the Association shall be held in 1927, at the same time as the Second International Conference of Phytopathology and Economic Entomology and that up to the time of the inauguration of this assembly the Council of the Association shall consist of the Wageningen Committee.

441. **United States: International Institute of Cooperation.** — A meeting of farmers organizations and co-operative undertakings was recently held at the Department of Agriculture, Washington, and a resolution was unanimously passed, urging the calling of a conference during the current year for the foundation of an *International Institute of Co-operation* in the United States. The immediate questions to be decided at the conference appeared to be: (1) collection and utilization of the facts relating to the co-operative movement in the United States and other countries; (2) the present position of the co-operative movement; (3) the preparation and professional training of managers and employees in the theory and practice of co-operation; (4) assistance to educational institutions, with a view to the improvement of the instruction relating to co-operation; (5) the utilization of the co-operative movement as a means of collective and national progress. (*The Agricultural Gazette of New South Wales.* Vol. XXXVI. Part 1. January, 1925.)

442. **Germany: Bavarian Bureau for the Sale of Materials for Increasing Crop Yields and for the Protection of Crops.** — An agreement, to come into force on 1 January 1925, has been reached between the Bavarian Government, represented by the Director of the Government Institute for the Cultivation and Protection of Plants (*Landesanstalt für Pflanzenbau und Pflanzenschutz*), and Herr LAUTERER in Munich, in virtue of which LAUTERER has undertaken the exclusive sale in all the agricultural districts on account of the Institute and in accordance with the instructions and prices as fixed by it, of bacteriological cultures, remedies for plant diseases and generally

for controlling all crop parts and also all apparatus required for the purpose. It is understood that sale will be confined to the cultures, remedies and apparatus prepared by the Institute or by other persons on its behalf, and the Office may sell substances and apparatus of foreign manufacture only when it has in each case the express permission of the Institute (*Praktische Blätter für Pflanzenbau und Pflanzenschutz*, Year 11, Part 2, 1925).

443. **Austria : State Activity in Lower Austria in regard to Land Improvements.** — In a report published by Herr STUTZ director of the Technical Agricultural Section of the Government Hydraulic Office of Lower Austria (*Tätigkeitsbericht des Vorreferates für Kulturtechnische Angelegenheiten der n. 8 Landesregierung für das Jahr 1924*, Vienna, 1925) an account is given of the work accomplished in the different communes of the region by the Office which in 1923 had 134 improvement works under its charge. In 35 communes 1 473.73 hectares had been drained and 10.689 square metres of open ditches had been dug for drainage purposes. The total cost amounted to 9664 million crowns. In order to facilitate the completion of these works, the Lower Austrian and the Federal Governments granted loans without interest to Consortia for Improvements in the proportion of 60 to 90 % of the total cost. Repayment of these loans is to be made within 3 to 7 years after the completion of the work. The amount of the loan and the date of repayment are fixed with reference to the financial and economic circumstances of the Commune in which the improvement works are being carried out. An irrigation plant has been installed in one of the Communes and in others, 73 in all, a water supply has been installed, and in addition there have been 40 schemes of other types. The Technical Section already mentioned drafts such schemes free of charge, supervises the work in Progress and approves it when completed. Certain works have had to be deferred temporarily on account of lack of funds.

444. **Brazil : Yield of the Seed Farm in São Simão (Brazil) from 1920 to 1922.** — "O Serviço de Inspecção e Fomento Agricola" of the Ministry of Agriculture, Industry and Commerce of the State of San Paolo has published a collection of statistics showing the quantities of seeds, cereals, forage plants, etc., produced in the period stated and amounting in all to 7335.74 quintals. This report gives a general idea of the financial aspect of the production. (*Serviço de Inspecção e Fomento Agricola, Ministerio da Agricultura, Industria e Commercio. Producção do Campo de Sementez de São Simão*, 1925).

445. **Brazil : New Agricultural and Zootechnical Services.** — By a recent decision the Government of Santa Catherina has established a remount station at Joinville, where a considerable dairy industry is developing.

The Government of Parahuja do Horte, with the object of making provision for the cattle-pasturing industry, has published a decree by which a *Serviço de Defensa Pastoril* (Service for the Protection of pasture lands) is constituted. (*Brazil-Ferro-Carril*, Year XV, Vol. XXVII, No. 376, 1924 and Year XVI, Vol. XXVIII, No. 379, 1924).

446. **American Parasitological Society.** — At a meeting of students and others interested in parasitological studies, held at Washington, in December 1924, the American Society of Parasitologists was formed for the presentation and discussion of new and important facts and problems in this branch of study and for the adoption of measures and proposals to encourage

in the United States the development of instruction and experimental work in parasitology. The members of the Society may be either members with full voting and other powers or honorary members. Every person interested in parasitology is eligible for full membership.

447. **International Society for the History of Science.** — This Society has been founded in the United States with the object of ensuring the maintenance of "Isis", an international review dealing with the history of science. The review, which is edited by G. SARTON (Cambridge, Mass.) has become the official organ of the Society of which L. G. HENDERSON (Cambridge, Mass.) is the chairman, and D. E. SMITH (Columbia Univ. New York), the Secretary.

448. **British Committee of Agricultural Meteorology.** — The British Ministry of Agriculture and Fisheries has appointed a permanent advisory Committee for all questions relating to agricultural meteorology.

449. **West Indies: Report of the Agricultural Department of St. Vincent for 1923.** — The Report deserves careful study; the account of experiments with varieties of sugar-cane is of special interest at the present time. In regard to crop pests, it is shown that success may be obtained by community action. The description of researches on cotton should be studied by growers of West Indian cotton; during the last two years there has been great improvement in the yield per acre. Reference is made to Land Settlement and Credit Societies. (*Report by the Imperial Commissioner of Agriculture for the West Indies*, 1924).

450. **The National Research Council in Italy.** — This Council was established as a corporate body by a Royal Decree of 16 November 1923, and is affiliated to the International Research Council the head quarters of which is at Brussels. Its objects are: (*a*) to co-ordinate and encourage national activity in the different branches of science and applied science; (*b*) to keep in touch with the different Governments in regard to all questions relating to the sciences and their practical applications, the solution of which is of interest and value to the country; (*c*) to establish and direct, where required, scientific laboratories of a general and special character. The annual receipts of the Council are made up as follows: (1) the annual contribution allotted from the Education budget; (2) contributions by public or private bodies either as donations or subscriptions; (3) possible working profits. Its capital is built up (*a*) from donations made for the purposes; (*b*) from funds assigned with this object by the Council, out of any surplus on the yearly budget. (*Bollettino Scientifico Tecnico*, Year VI, No. 6, 1924).

451. **National Association of the Agricultural Press in Italy.** — Founded on 1 January 1923. Its objects are as follows: (*a*) to protect the moral and professional interests of members; (*b*) to establish joint services of information and enquiry; (*c*) to organize by common agreement the consideration and advocacy of questions of interest to national agriculture and suitable propaganda, and to develop Italian Agriculture; (*d*) to make effective provision for the proper insurance of members.

452. **Russia: The Technical Chemical Bureau of the Russian Sugar-Refining Union at Kiev.** — The work of this Bureau is to train chemical experts for the refineries belonging to the Union and to carry out scientific research in the chemistry of the refining process. Consideration is being given

to the drafting of a model form for the reports on the regular work of the various manufactories belonging to the Russian Sugar Refiners Trusts. In 1923 the Office had already organized a central inspection of the chemical technique of the sugar-refineries under its control, and thus became fully acquainted with their requirements and deficiencies. Previous to this inspection, there had been shortages of output from the factories in proportion to the quantity of raw materials and to the entries in the laboratory note-books and the accounting registers, but now strict enquiry has been instituted into the causes of shortage resulting in more careful management both on the administrative and the technical side. The statistics collected for the compilation of the report on the first year's working of the central inspection are in themselves proof of improvement. The general results will be discussed at a meeting of the chemical experts, and will serve as a basis for further improvements as regards the output of the refineries.

The Bureau is managed by a Committee of three members and the staff consists of a chemical engineer, five travelling experts, and a correspondence clerk. (*Zeitschrift f. die Zuckerindustrie der Cecoslovakischen Republik*, Year XLIX (VI) No. 5, 1924).

453. **Russia: The Ukraine Committee for Scientific Agriculture.** — This Committee was formed to continue the work of the former Scientific Committee of the Imperial Ministry of Agriculture, and up to 1923 its headquarters were at Kiev. It was later transferred to Kharkof, the capital of the Soviet Republic of the Ukraine. In addition to the President's Office and the Secretariat, which among other duties maintain relations with the International Institute of Agriculture at Rome, the Committee is composed of the following sections:

1. A technical Secretariat, with a sub-section engaged in establishing scientific agricultural terminology in the Ukraine language and in publishing a dictionary of these terms, and other subsections in charge of bibliography, the library, the Review issued by the Committee, the museum and the correspondence;

2. The following sections: rural economy, meteorology, chemistry, soil science; botany, including systematic botany, plant physiology, seed selection the botany of cereals, marsh, industrial and medicinal plants, phytopathology and experiment stations; zoology, including entomology, bee-keeping and fish breeding; rural demography, stock-breeding, veterinary science, cultivation of pastures, methods of cultivation, horticulture, sylviculture, land improvements and agricultural instruction. In addition to these services there are nine Commissioners with special responsibilities for the protection of natural wealth, the general direction of the work of the district organizations as well as that of the Experiment Station, control measures against agricultural pests and drought, questions of irrigation and water supply, and of roads and communications, the utilization of the subsoil, more especially of the phosphate layers.

Conferences and Congresses.

454. **Spain: Proceedings of the Seventh International Congress on Olive Cultivation. Seville, 5-19 December 1924.** — The Organizing

Committee of this International Congress has accepted the tender of the publishing firm "Sucesores de Rivadeneyra". The Proceedings will be distributed gratuitously to members of the Congress, and will also be for sale at 40 and 50 pesetas in paper cover or bound cloth respectively.

The Firm Rivadeneyra accepts advertisements relating to olive oil production for insertion in this important publication which will be published in Spanish and French.

455. **United States: Report on the International Dairy Congress, October 1923** (*received* 1925). — This report has been published by the United States Department of Agriculture, Washington. For 20 years past successive International Dairy Congresses have been held in different European countries. The first was the Brussels Congress in October 1923, at which the International Dairy Federation was founded. There followed in order, the Paris Congress in 1905, a Congress at the Hague in 1907, at Budapest in 1909, at Stockholm in 1911, and at Berne in 1919. During the period of the War the Congresses were suspended, and it was not till 1923 that a series again took place namely at Washington, 2-12 October, at Philadelphia, 4 October and at Syracuse, N. Y., 5-10 October. The last Congress was organised by the "World Dairy Congress" in pursuance of the authority given by a Law of the United States Parliament, dated 3 March 1921. The co-operation of the American Government was secured through the Department of Agriculture as well as through the other Ministries, and the Congress was organised by agreement with the *Fédération Internationale de Laiterie* and with the co-operation of the national and local organisations of the United States.

As already stated, conferences took place in succession at Washington, Philadelphia and Syracuse, where an International Dairy Exhibition was also held, including select breeds of dairy cattle acclimatized in the United States, dairy industry products, butter, cheese, condensed milk, etc., and all the equipment used in the industry itself. The programme of the Congress was comprehensive and discussions took place on all the questions relating to the object of the Congress, which was defined in the official programme as the establishment of an International exchange of recently acquired knowledge, both scientific and practical, relating to the dairy industry, and also the issue of a statement on the methods and results of the various ways of using milk and its derivatives for human food. The report contains *in extenso* the communications made by a number of scientific experts in each of the 27 sections into which the Congress was divided. The international trade in milk, the increase of the milk yield in the United States, the working of the Regional Milk Council System in the United States, the employment of condensed milk and milk powder in human food, the milk supply of towns, questions relating to cheese-making, methods of technical instruction for the staff of dairies, the food value of milk, ice creams, methods of improving the food uses of milk, dairy instruction in various countries, the education of the consumer and co-operation methods, milk tests, milk transport, inspection of dairy products, feeding of dairy cows, the chemistry and bacteriology of milk, dairy equipment, scientific study of milk and milk powder, breeding of dairy cattle and their diseases; — the above is a list of the subjects treated in the different sections of the Congress.

The Congress did not pass any resolution on the subject of international

relations which are not as yet completely established. Besides the meetings a number of excursions were organized, enabling the members of the Congress to visit dairies, pasturage centres, laboratories, model farms, experimental institutes, etc.

In conclusion while the report may be said to form a complete encyclopedia on the subject of milk, the object which has been specially kept in view is to emphasize the influence of economic problems of international trade and consumption of dairy products; prophylactic methods of dealing with live stock diseases and supervision of the sanitary conditions under which stock is kept; the standardization of products, the effect of the consumption of milk and milk products on the general health and the importance of such consumption on the physical and intellectual development of the people. (*Proceedings of the World's Dairy Congress*, Washington, D. C., October, 2, 3; Philadelphia, Pa., October, 4; Syracuse, N. Y., October 5, 6, 8, 9, 10; 2 vol. in 8º, p. XVI + 1599. Washington, D. C., 1924).

456. **Great Britain: Sixth Congress of the International Federation of Professional Horticulturists, London, 28-30 May 1924.** — The publication of the Report of this Congress supplies an account from various sources of the situation of world horticulture, as well as an official statement of the activities of the Federation. The reports relate to the following countries: France: R. BARBIER, General Secretary of the Federation; Holland: H. C. VALETON, General Secretary of the Netherlands Horticultural Federation; Belgium: C. PYNAERT, President of the Chamber of Belgian Horticulturists; Great Britain: S. W. HALE, secretary of the Chamber of Horticulture; Switzerland: A. STAHEL, Secretary of the Federation of Swiss Horticulturists.

A report of the working of the B.I.E.N.H. (*Bureau International d'Enregistrement des Nouveautés Horticoles*), which is beginning to be freely used by horticulturists, explains the advantages offered by the Bureau to the discoverers of new species. As regards arbitrations and disputes as to international horticultural transactions, the Congress resolved that every Horticultural Association should, when necessary, place itself in direct communication with the Chamber of International Commerce and make use of its services. Questions of phytopathology and the prohibition of importation were the subject of a detailed report by M. G. PYNAERT and also of a report by Mr. A. GIBBON on the Canadian Legislation for plant diseases. In regard to quarantine measures, questions relating to bulbs, rose bushes grafted by the Manetti methods, orchids, fruit, etc., came up for consideration and in the discussion that followed a resolution was passed in favour of the meeting of an International Conference at Washington to examine afresh, and in all its bearings, the problem of the transport of living plants from the international point of view, and to secure that the methods of inspection and testing should be practical.

The next conference of the Federation will be held in Holland in 1925 (The International Federation of Professional Horticulturists. Report of the Congress held in London, Connaught Rooms, Kingsway, W. C. on the 23 and 30 May, 1924; 63 pp. in small 8vo. Orleans.).

457. **Denmark: Fifth International Chemical Conference at Copenhagen, 26 June to 1 July 1924.** — The Council of the Union of Pure and

Applied Chemistry unanimously adopted the proposals of the Committees, relating to the reform of nomenclature, bibliographical documentation and also on raw materials and industrial products, physico-chemical standards, pure chemicals for experiments, tables of constants, solid and liquid combustibles, ceramics, the preservation of foodstuffs, industrial hygiene, and scientific and industrial plant.

The reports of the Committees were supplemented by four lectures given by the following: E. BILLMANN, on the quinhydrone electrode and its applications; — H. BOHR, on the problems of the atomic theory; — J. N. BROENSTED, on some views as to the definition of acids and bases; — S. P. L. SOERENSEN, on the solubility of Proteins.

458. **Reports of the First International Seed Trade Congress.** — This Congress was held in London from 7 to 10 July 1924, simultaneously with the International Seed Testing Conference, and was attended by representatives of Canada, Czechoslovakia, Denmark, Danzig, France, Germany, Great Britain, Italy and the United States of America. At its final sitting the Congress adopted an international model form of contract for the purchase and sale of seed for agricultural purposes. Copies of this form are appended to the published report of the Congress. (The Agricultural Seed Trade Association of the United Kingdom. Report of the Proceedings of the First International Seed Trade Congress held in London, July 7 to 10, 1924, 74 pp. in small 8vo).

459. **First World Energy Conference in London, 30 June to 14 July 1924.** — The object of this Conference was to lay the foundations for international co-operation in the utilization of energy in its various forms, including the ascertainment of all natural sources of energy, the economic use of combustibles, the industrial applications of energy, the standardization of industrial materials, international agreements for the employment of electric energy and for financing industry, for transport, scientific experiments, industrial schools, etc. Important economic problems were considered from the international standpoint and it was decided that the Second Conference should be held in Rome in 1927. A permanent international organization was formed with headquarters in London.

The Conference was followed by the first reunion of the International Commission on Electricity which is endeavouring to standardize the regulations respecting electric machines and installations.

460. **International Congress for the Scientific Organization of Labour.** — Prague, 20 July 1924.

461. **Report of the First Pan-Pacific Food Conservation Conference.** — The General Proceedings of this important gathering, which was held at Honolulu from 31 July to 14 August 1924, have been published in the *Mid-Pacific Magazine* (Vol. XXIX, No. 1: January 1925), with very striking illustrations. The resolutions passed at the Conference had been already reported in the *Bulletin of the Pan-Pacific Union* (New Series, No. 60, 1924).

462. **International Congress of Agriculture, Warsaw, 21-24 June 1925.** — This Congress, proposed by the International Commission on Agriculture, as announced in the *Int. Rev. of Sc. and Pract. of Agric.*, Jan.-March, 1925, No. [illegible], will include five Sections, whose programme is as follows :—

Rural Economy : 1. Influence of the agricultural organizations on the agricultural policy of the State ; 2. Effect of capital and labour as factors tending to intensification of agriculture ; 3. Large and small agricultural undertakings as influencing commercial relations between nations ; 4. Present organization of the national rural credit institutions : organization of international rural credit ; 5. Post-war agricultural crises ; fluctuations in production and consumption in the different countries and disproportionate rises in prices ; 6. Immigration and emigration of rural labour ; 7. Improvement in the methods of rural labour.

Plant Production : 1. Use of gas and electric motors for agriculture ; 2. International organization of the control of plant diseases and its practical realization ; 3. Value and importance of lupins according to the latest experiments ; 4. Application of the principle of standardization in agricultural production ; 5. Economic use of phosphatic fertilizers according to the latest experiments ; 6. New problems and new methods of control of drought.

Animal Production : 1. Importance of local breeds ; 2. New opinions as to the nutritive value of forage crops, the importance of vitamines, character of the proteins, function of the mineral salts, etc. ; 3. Feeding of dairy cattle in relation to :— (*a*) the classification of forage ; (*b*) the keeping of milk records ; 4. The relative value of the different breeds of horses according to the experience gained in the war ; 5. Simplification of the methods of selection of domestic animals ; 6. Modern pisciculture in stew ponds ; 7. International agreements for the control of the diseases of domestic animals and their practical application in the case of the following diseases :— epizootic foot-and-mouth disease, contagious cattle pleuro-pneumonia, cattle plague, tuberculosis.

Agricultural Industries : 1. Development of the agricultural industry towards the form of the large industry and the interests of agriculture ; 2. Organization of agriculture on industrial lines on the small rural holdings ; 3. Beet-root sugar and cane sugar.

Agricultural Experiment and Instruction. — (*a*) 1. Organization of collective experiments over long periods and their importance for agriculture ; 2. Co-ordination of agricultural experiment by means of an international agreement as to the best use of scientific work and the best means of advancing the solution of the various problems ; 3. Organization and scope of the scientific institutions for agricultural investigations , 4. Organization of experiments in stock-breeding ; 5. Unification of the methods for analysing fertilisers and seeds. (*b*) 1. Methods for diffusing vocational instruction among the rank and file of agricultural producers : adaptation of primary instruction and of the curriculum of the training colleges to the requirements of the rural population : after school instruction in agriculture : instruction in agriculture for ex-soldiers , how to utilize the experiment stations for agricultural instruction ; 2. How to adapt the higher schools of agriculture to the changes which are coming about in the structure of rural life ; 3. Organization of apprenticeship in agriculture.

Papers relating to the subjects of the Congress must be sent to the Organizing Committee (30. Rue Kopernik, Warsaw) not later than 15 April and 15 May, the former date for the summaries of the papers and the latter for the completed texts.

4[illegible]. **World's Forestry Congress. Rome, May 1926.** — The Organising Committee intend that this Congress shall be conducted on thoroughly practical lines and that such problems only as are of real international importance shall be discussed. In particular the object of the Congress is to consider :—

(a) the possibility of unifying the present methods of compiling forestry statistics, of fixing the periods when the census should be made in the different countries and of establishing a regular international service of forestry statistics and information ;

(b) the best means of improving international trade in timber and other forest products ;

(c) technical, economic, legal and administrative questions relating to the proper preservation and improvement of existing forests, the regeneration of denuded mountain slopes and the utilization of waste land ;

(d) the best means of obtaining a better utilization of the world's forest reserves ;

(e) any other question of international importance relating to forestry.

The Congress will have 4 Sections, corresponding to the divisions of the Programme.

I. Forestry in its statistical, political, economic and legal aspects. Instruction in Forestry.

1. Statistics of area, production, consumption and trade.
2. Census taking, including uniformity in method and frequency.
3. Forests in relation to the general interests of a country.
4. State intervention in the afforestation of bare lands belonging to private persons, Communes, Associations, etc., and in the improvement of existing forests.
5. State intervention in the administration of forests owned by private persons, Communes, etc.
6. The organisation of the State Forestry Services in various countries.
7. Legislation relating to forests.
8. Revenue from forests. Taxation.
9. Credits for forests.
10. Forestry instruction in different countries.
11. Research, experiment and information stations.

II. Trade and Industry in timber and other forest products.

1. Action to be taken for the improvement of the international trade in timber and forest products, including the unification of commercial methods and practice, model contracts, unification of commercial timber measurements, etc.
2. Tariffs for timber transport.
3. Customs duties.
4. Unification of the customs classification of forests products.
5. Saw-milling industry.
6. Manufacture of wood pulp for paper-making and of cellulose, and kindred industries.
7. Various industries engaged in the use and conversion of wood.

8. Resin industry.
9. Other industries that make use of forest products other than wood.
10. Wood distillation industry.
11. Minor industries connected with forestry.

III. TECHNICAL PROBLEMS RELATING TO FORESTRY AND FORESTRY OPERATIONS.

1. The natural factors in production. Ecology applied to forestry.
2. Geographical distribution of forest trees.
3. Forest trees. The best timber trees for introduction and cultivation in the different climatic zones for the purpose of improving timber yields.
4. Forestry operations, including felling, transport, etc.
5. Collection of forest products other than wood, *e. g.*, barks, resin, saps, leaves, etc.
6. production of vegetable fuel (charcoal) and the usual methods of carbonization.
7. Collection and preservation of the seeds of forest trees.
8. Nurseries.
9. The offorestation of bare lands.
10. Chemical fertilizers in forestry.
11. Improvement of existing forests with special reference to production
12. Cultural practice and treatment of forests.
13. Working plans or schemes and their value.
14. Methods of seasoning and preserving timber.
15. Control of forest fires.

IV. REAFFORESTATION OF MOUNTAIN AREAS. CONTROL OF TORRENT WATERS. PLANT DISEASES. MISCELLANEOUS.

1. Preservation of mountain lands, pasture lands, lands fit for cultivation
2. Regulation of mountain water systems.
3. Artificial lakes in reference to the afforestation of bare lands, and the control of mountain water-systems.
4. Improvement of pasture and agricultural land.
5. Planting and regulation of pasture lands belonging to Communes or Associations.
6. Control of torrent waters; major and minor works connected therewith.
7. Legislation on the correction of torrents, the control of mountain watersystems and mountain lands.
8. Plant diseases, insect pests, damage caused by wind, fire, snow, etc., and methods of protection.
9. Tropical forestry resources and the possibility of their utilization for the benefit of countries with inadequate timber yields.
10. Forests in connection with the development of tourist activity and aesthetic education.
11. Propaganda work for forest and stream. Arbour day celebrations.
12. Game and fishing. Miscellaneous.

Reports must reach the Bureau of the International Forestry Congress

at the International Institute of Agriculture, Villa Umberto I, Rome, before 15 February 1926.

The subscription is fixed at 50 French francs.

464. **International Congress for the Study and Protection of Birds, Luxemburg, 13 April 1925.** — This International Congress was held under the auspices of the Luxemburg Government and the League of Belgium, France and Luxemburg for the Protection of Birds: Apply: M. J. MORBACH, *Esch sur Alzette, Luxemburg.*

465. **International Goat Keeping Congress, Friburg, September 1925.** — This Congress will be held on the occasion of the Swiss Agricultural Exhibition and the discussions will deal with the three following subjects: 1. goats' milk, its composition and properties; 2. the diseases of goats, and particularly anemia and tuberculosis, as also prophylaxis and remedial measures; 3. feeding of goats with particular preference to the proper exchange of mineral substances.

466. **Winter Session in the "Agricultural Week" in Berlin of the Deutsche Landwirtschafts-Gesellschaft Berlin, 21 February 1925.** — Special sections and meetings took place for discussion of the methods respectively of cultivation, manuring, sowing, pomology and oenology, agricultural machinery, zootechnics, farmhouse management and colonial subjects. Among the principal papers on agricultural scientific subjects placed on the agenda may be mentioned: Dr. SCHWARTZ (Berlin-Steglitz) on the appearance of *Doryphora* in potatoes and control measures; Dr. BAUR (St. Blasien) on meteorological forecasting at the different seasons of the year; Dr. RAUM (Weihenstephan) on weed control in meadowland; Drs. BIEREI (Gross-Dobritsch), GERLACH (Berlin) and Prof. NEUBAUER (Dresden) on chemical fertilising substances. Agricultural Councillor BUSZ (Rastatt) and Prof. ZADE (Leipzig) contributed papers to the Seeds Section; Prof KROEMER (Geisenheim on Rhine) and the expert horticulturist A. J. WERTH (Bonneckenstein in the Harz) to the viticultural and pomological sections. Other reports dealt with home gardening (Dr. EBERT, Berlin) and general household management (Frau BÖHM, Königsberg), farm machinery (Prof. E. MEYER, Hohenheim; COLSMAN, Linderberg; OBENDORFER, Limbach, and DEKRER, Düsseldorf); lupin growing (Dr. STORMER, Stettin-Neutorney, and BREDE, Klockow of Karstädt), and in the colonial Section, the conditions of agriculture in Turkey (Prof. BREDEMANN, Landsberg) and in Egypt (Dr. SCHNELL, Berlin-Dahlem). Zootechnical reports were presented by RAU (Berlin) on horse-breeding; on cattle-breeding by Dr. RATGEN (Wormeln) and by MUSSENMEIER (Berlin); Dr. FRÖHLICH (Halle on Saale), Prof. GOLF (Leipzig) and Dr. von FALCK (Berlin) on sheep-breeding; BRUNING (Haus Südhoff) and TICK (Othal) on pigbreeding; von WANGENHEIM (Wusterhausen) on poultry-breeding, and in addition Prof HONCAMP (Rostock in Mecklenburg) gave a report on stock feeding as based on the results of the most recent experiments while Prof. WIEGNER (Zurich) described experiments in forage preservation in Switzerland.

Reports were also presented of the many various branches of the activity of the *Deutsche Landwirtschafts-Gesellschaft*.

467. **Brazil: National Congress on Products yielding Oil, Fats and Resin.** — As a result of the proceedings of this Congress the general recog-

nition of many Brazilian raw materials was established, these being excellent substitutes for foreign products imported into Brazil on a large scale. Among these is "bataua", the seed of an oil-yielding plant native to the north of Brazil and possessing the same digestive properties as olive oil, and the "batiputa" another seed produced in the States of Parahyba, Pernambuco and Rio Grande do Norte, the oil of which is said to have valuable culinary and medicinal qualities. Seeds were also shown of a Rosacea which grows freely in the Amazon district and produces a drying oil which is a useful substitute for linseed oil.

Reports were presented on almond oil and on analyses of foreign imported oils. These analyses show that the greater part of the olive oil imported contains up to 90 % of cottonseed oil, while most of the imported linseed oil contains up to 20 % of resins and various mineral oils, which could be obtained more cheaply in Brazil. Communications were also read on the subject of coco-butter, the sale of which is prohibited by the Health authorities of Rio Janeiro, while the Congress passed a resolution declaring that there was no justification for this prohibition which did much to prejudice the trade in the product.

Dr. E. LINDERBERG explained in some detail a theory on the fixation of types of linseed oil. Dr. L. TRINDADO, delegate of the *Associação Commercial de São Paulo*, obtained acceptance of a resolution for the establishment of a Commercial and Technical Information Service on Brazilian raw materials, to be supported by the trade associations, the engineering and industrial societies, the Chemical Society and kindred associations of the Federal District and of the States of the Union. (*Brazil-Ferro-Carril*, Year XV, Vol. XXVII, No. 378, 1924).

468. **Report of the Congress of the Municipalities of the State of Minas Geraes (Brazil).** — The reports of this Congress which was held from 3 to 10 June 1923 at Bello Horizonte are published in a volume of considerable size. As regards agricultural questions in the Section on Labour and Stock-Breeding the following subjects may be mentioned : the preservation of forests and re-afforestation ; artificial meadows, hay-making and ensilage ; animals useful and harmful to agriculture, contagious diseases of stock, mounting stations and rural credit. (*Annaes do Congresso das Municipalidades Mineiras*, reunido em Bello Horizonte de 3 a 10 junho de 1923 ; large 16mo., pp. 659, with illustrations. Bello Horizonte, 1924.

469. **Spain : IV National Irrigation Congress, Barcelona, May 1925.** — The three previous Congresses were held respectively at Saragossa in 1913 and Seville in 1918, and Valentia in 1921. The following subjects will be discussed on the present occasion :—

Regulations for the utilization of public water supplies ; report on the relation between the industrial utilization of water and the irrigation of agricultural land ; regulations for the use of the water from the Aragon and Catalonia canal ; the development of cultivation in relation to irrigation and home colonization ; irrigation consortia, facilities for their establishment and working ; relations between landowners and the surface irrigated ; promotion of small irrigation consortia.

470. **Spain : Congress of Vine-Growers at Valentia.** — This meeting took place in November 1924 under the presidency of the chairman of the *Fe-*

deración de Viticultores de Levante, and there were present representatives of the Vine Growing Unions of *Rioja, la Mancha, Cataluña, Murcia* and *Alicante*. The following proposals were approved : (1) The introduction of declarations of crops and of the transport of wine as a practical precaution against fraud ; (2) The complete application of the law of 1895 which regards as adulteration of wine the addition of any substance whatever which is not derived from the fermentation of the grape ; (3) special tariffs for the transport of grapes or wine, intended to increase the consumption of these two products ; (4) conclusion of commercial agreements with Belgium, Germany, Czecho-Slovakia, Poland and the South American Republics. Several recommendations were made relating to fiscal charges, vine-growing and statistics (*La Revista vinícola y de Agricultura*, Year XLIII, No. 24, 1924).

471. **Spain : Oil Conference, Madrid, November 1924.** — Representatives were sent by the Chamber of Agriculture, oil manufacturers, olive-growers, exporters, the Spanish Agricultural Associations and other bodies. Resolutions were passed with regard to : (1) the supply and distribution of olive oil in the national territory ; (2) regulation of exportation. A full report of the resolutions appeared in the periodical *El Progreso Agrícola y Pecuario*, Year XXX, No. 1367, pp. 689-693, 1924.

472. **France : 60th Pomological Congress, Angers, 18-19 September 1924.** — Promoted by the *Société Pomologique de France*. The subjects of the agenda were as follows : (1) mechanical cultivation in orchards ; (2) catch crops, in connection with intensive fruit growing ; (3) fruit culture as a catch crop in the vineyard ; (4) systematic manuring of fruit trees ; (5) improvements in fruit growing as the result of horticultural and pomological competitions ; (6) insects and cryptogamic diseases of the strawberry ; (7) fruit preserving. The next pomological conference will be held at Toulouse within the current year.

473. **France. Franco-Belgian Conference of Small Holders. Lille, 25-27, September, 1924.**

474. **Italy : 14th Annual Reunion of the Italian Society for the Advancement of Science, Pavia, last week in May 1925.** — This meeting will follow immediately on the celebration of the 1100th Anniversary of the University of Pavia.

475. **Italy : The Fifth Italian Forestry Conference, Campobasso, 1925.** — Organised under the auspices of the *Federazione Pro Montibus*. The subjects to be discussed are : (1) the new forestry legislation and its application ; (2) scheme for a more extensive and more effective forestry policy in Italy ; (3) the technique of re-afforestation according to the most recent views and experiments ; (4) the improvement of mountain pastures in Italy ; the work done and to be done ; (5) woods, and common rights in regard to the application of the Royal-Decree-Law of 22 May, 1924 No. 751 ; (6) improvement of mountain land and the regulation of torrent waters ; (7) the National Parks of Italy.

A large Forestry Exhibition will be held simultaneously with the Congress.

Exhibitions, Fairs and Competitions.

476. **Germany: Publicity Fair, Leipzig, 1-17 March 1925.** — Held in connection with the annual spring fair.

477. **Belgium: International Exhibition of Modern Improvements in Town and Country Domestic Work. Laeken.** — Will be opened on 15 July under the presidency of the Minister of Agriculture, Baron RUZETTE, at the Institute of Farm Household Management (*Institut ménager agricole*) of Laeken. Some international meetings of great importance will be also held on this occasion: (*a*) representatives of Household management instruction; (*b*) representatives of Farmwomen's Circles in different countries; (*c*) representatives of Rural Betterment Committees: (*c*) representatives of Family Education. On the agenda of this last meeting is placed the important question of the use of electricity in the country districts.

Commissioner for the Exhibition: M. DELACROIX, *Chaussée Romaine, Laeken*. For information, apply to M. CIELE, 40, Rue des Joyeuses Entrées, Louvain. Belgium.

478. **Brazil: Regional Seed Competitions in Brazil, 1925.** — The Minister of Agriculture of Brazil has approved the measures suggested by the "Serviço de Fomento" for holding seed competitions in 1925 in the following States: Amazon, Parà, Maranhão, Cearà, Parahyba, Pernambuco, Alagoas, Bahia. (*Brazil-Ferro-Carril*, Year XVI, XXVIII, No. 383: 1924).

479. **Cuba: International Horticultural Exhibition. Havannah, 26 February-8 March 1925.** — For information apply to M. P. D. de POOL, Apartado 997, Havannah.

480. **Spain: Fifth National Zootechnical Competition. Madrid, May 1926** organized by the *Asociación General de Ganaderos*, Huertas 30 Madrid.

481. **Spain. Zootechnical Competition, Xeres de la Frontera, 24-26 April, 1925.** — Organizing association the *Associación General de Ganaderos*. Programme: *Horses;* saddle horses, pure bred Arabs, carriage horses; — *Asses;* Andalusian and similar breeds, Majorca, Catalan and Leon breeds; — *Cattle:* Andalusian breeds of Estremadura, foreign beef cattle; — *Sheep;* fine wool, semi-fine and ordinary, cross-bred improved for meat, foreign breeds; — *Pigs:* coloured Andalusian and Portuguese, Estremadura spotted breed, unspecified breeds, pigs for fattening, foreign breeds: crossbred for improving; — *Goats;* local breeds, Spanish breeds; *Poultry;* fowls and other kinds of poultry; — *Watch-dogs;* mastiffs, sheep-dogs, etc.

482. **United States: Permanent Exhibition of International Trade at New Orleans, U. S. A.** — The American Government has granted the Trade Association of New Orleans the use of one of the Army stores which were erected in the town during the war. This building can be adapted as a permanent exhibition of international trade. Merchants of the leading nations will be invited to send samples of their products.

483. **Scheme for a Colonial Exhibition at New York.** — A Committee for carrying out this scheme has been formed by M. EMILIO UTARD, with the co-operation of M. GASTON LIEBERT, Minister Plenipotentiary, Director of the French Information Bureau at New York and of M. DE LA ZARRIE, editor of the Review, *French Colonial Digest*, published at New York.

484. **France : International Rose Show. Bagatelle (Bois de Boulogne), 1925-1926.** — Will be held in the rose-garden of Bagatelle and will have special reference to new varieties. The plants must be grown in pots, and at least five specimens of each exhibit sent, accompanied by particulars of their place of origin, and stock, and when necessary information as to the proper management of the plant. Apply to : M. FORESTIER, *Conservateur des promenades de Paris, 4, Route du Champ d'Entraînement, par Neuilly (Seine).*

485. **International Exhibition of " White Coal " and of Tourist Facilities, Grenoble, France, May-October 1925.** — The main object of the exhibition which is organized by the General Council of the Isère, the city of Grenoble and the Grenoble Chamber of Commerce, is to illustrate the progress made in recent years, in France and in other countries, in electricity regarded not merely from the side of production and distribution of energy, but also from the point of view of the applications of white coal to numerous branches of human activity. For information apply to M. PIERRE CHABERT, *Commissaire général adjoint, chargé de sections étrangères*, 61, *Boulevard Haussmann, Paris.*

486. **National Seed Fair. Paris, 17-25 January 1925.** — Organized by the regional office of the Nord and the departmental officers of the Seine, the fair was divided into four sections :— I. a fair properly so-called, reserved (*a*) for the associations of seed producers and for the Agricultural Experiment Stations ; (*b*) for the agricultural unions for the sale of seeds ; (*c*) for farmers who only sell their own crops ; II. an exhibition open to dealers in grain, and seed, including tubers ; III. a special section for sugar beet seed ; IV. a section for new species of seeds. Apply : M. EUGÈNE ROUSSET, *Directeur des Services agricoles de la Seine.*

487. **General Agricultural Show, Paris 10-15 March 1925.** — The following divisions were included : (*a*) a competition of breeding animals, cattle, sheep and pigs ; a butter and cheese competition ; a sheep-dog trial and a show of dead poultry, all open only to breeders and farmers resident in France, Algeria and the Colonies and Protectorates, and to the breeding societies and unions ; (*b*) a competition for dairy, agricultural and horticultural produce, wines ciders, jams, brandies, poultry and various products, of French or Algerian origin, or coming from the French Colonies or Protectorates.

488. **England : International Food Exhibition. London, 11 April to 2 May 1925.** — Covering all the food industries and including foodstuffs and prepared foods, machinery and apparatus for the preparation, serving and preservation of such foods, kitchen stoves and utensils, etc.

489. **Italy : Italian Competition for the Manufacture of Agricultural Refrigerators.** — In view of the development of the manufacture and trade in these machines, the Department of Agriculture in July 1924 instituted a competition for the construction of refrigerators specially designed for the preservation of eggs, butter, poultry, fresh fruit and vegetables. The competition closes on 31 December 1925 and a credit of 600 000 lire has been opened to meet the cost of awarding prizes.

490. **Italy : National Exhibition of Pure and Applied Chemistry. Turin, Spring 1925.** — Among the twenty classes of exhibits the following relating to the agricultural industries may be mentioned : the fermentation

and distilling industries ; — machinery and apparatus for chemical and agricultural chemical industries ;— refrigeration ;— fats and soap manufacture ; — breadmaking ; — leather, hides and tanning materials.

491. **Italy : First Italian Forestry Exhibition. Campobasso, 1925.** — This exhibition will be held on the occasion of the Fifth Italian Forestry Congress. There will be seven sections : I. Forestry and forestry instruction ; II. Forestry industries ; III. Special exhibits ; IV. Mountain Pastures ; V. Improvements of Mountain and Hydro-electric works ; VI. Exhibition of the Agriculture of Southern Italy ; VII. Shooting and Fishing.

492. **First Exhibition of Industry, Commerce and Agriculture, Fiume, Italy. August-September 1925.** — Under the auspices of the Union for the Extension of Trade and Industry, and under the patronage of the municipality of Fiume. All kinds of industrial and agricultural products are accepted : they are classed in groups and special exhibits (Exhibit of wines, food exhibits, etc.).

493. **Germany : Transport Exhibition. Munich, June-October 1925.** Divided into four sections : Land transport, including railways, tramways, street vehicles of all kinds ; sea and river transport, aerial transport ; posts, telegraph, telephone and radiotelegraph.

494. **Poland. National Horticultural Exhibition Lvoff, 26 Sept. — 5 Oct., 1925.** To be held contemporarily with a Conference on Horticulture. Apply, Exhibition Committee, Kopernika 20, Poland.

495. **Switzerland : Ninth Swiss Exhibition of Agriculture. Berne, 12-27 September 1925.** — Agricultural exhibits from other countries will only be accepted so far as they possess interest for the agriculture of Switzerland. The Exhibition will include agriculture, forestry and horticulture. For information, apply to the General Commissioner for the Exhibition, 7 Laupenstrasse, Berne.

Development of Agriculture in the Different Countries.

496. **Brazil : An Important Problem for Brazil.** — According to Dr. TEIXEIRA, in the present economic conditions, so full of uncertainty for very many countries, it is only from the land that Brazil can expect a prosperous development of the native wealth to the point of maintaining a sufficiently large export of foodstuffs, besides meeting the requirements of the home market. The Governments of the States, with the support of the Federal Government, must secure an understanding with the landowners for obtaining the expropriation of land required for land settlement, and must divide it into convenient lots, approached by carriage roads and must sell these lots to Brazilians and foreigners. At the same time it would be necessary to organize a body of experts for soil study and analysis, to advise as to the crops suitable for the different types of soil, the nature and quantity of fertiliser required and the breeds of stock suitable for the different localities. In this way a large demonstration area would be formed, which would effect great changes in Brazilian agriculture, and make Brazil a country of abundant food production (*Brazil-Ferro-Carril*, Year XV, vol. XXVII, No. 376, 1924).

497. **Brazil : Cotton Cultivation in the various States of Brazil.** — The Superintending Section of the Cotton Growing Service of Brazil (*Super-*

tendencia do Serviço do Algodão), taking into consideration the varieties of cotton and the plantation of cotton in the different States, has resolved on a special type for each separate zone adopting the following divisions

Para, Marannão and Piauhy; for the inland zones, "Moco" or "Serido"; for the littoral and wooded regions, the herbaceous kinds.

Ceara, Rio Grande de Norte and Parahyba: for the inland zones, "Moco" or "Serido"; on the lands subject to annual flooding, the herbaceous varieties.

Pernambuco, Alagoas, Sergipe and Norte da Bahia: for the inland districts "Moco" or "Serido" as well as "Verdão" or "Riqueza"; on the littoral or the wooded parts, herbaceous kinds.

Herbaceous varieties are also planted in Espirito Santo, Rio de Janeiro, S. Paulo, Minas (Sul and the Triangle districts), Goyaz, Matto Grosso, Parana, Santa Catherina and Rio Grande do Sul.

The variety "Rim de Boi" will be grown in the region of the Norte de Minas Geraes, including the bay of S. Francisco and the Southern part of the State of Bahia.

Applications for seed, forwarded to the *Superintendencia*, must state the quantity of seed required as well as the area which it is intended to plant. Persons who receive seed are under an obligation to restore, at the time of picking, to the *Serviço do Algodão*, a double quantity of seed. (*Gazeta da Bolsa*. Year VIII, No. 5, Rio de Janeiro, 1925).

498. **Community Cotton Production.** — COOK O. F. and MARTIN R. D. *United States Department of Agriculture Bulletin No.* 1384, pp. 20. Washington, D. C. 1924. Community production of cotton is the growing of only one variety in each district. Under this system, the deterioration of varieties is avoided, due to the mixing of seed at the ginneries; production is based on pure seed, superior varieties are utilised, better cultural methods are employed, greater efficiency is secured, and commercial advantages are obtained from the marketing of a uniform product. An adequate supply of pure seed of a standard variety is fundamental.

The bulletin outlines the one-variety community method of cotton production, including the selection of a variety, the maintenance of seed stocks, and the organisation of centres for the supply of pure seed.

499. **English Wheats.** — HUMPHRIES D. A. E. *The London Corn Circular Supplement*, pp. 1-2, January 12, 1925. The following notes are from a lecture given at the City of London College by Dr. HUMPHRIES, the well-known authority on wheat, who has studied the various aspects of wheat for over twenty years.

About the middle of the last century the area under wheat in the United Kingdom was 4,000,000 acres, whereas in 1914 it had been reduced to 1,375,000 acres, and in 1923 was only 1,800,000 acres. In 1863, 72 % of the total consumption was home-grown; at the present time little more than 13 % of requirements reaches the mills.

The best wheat is grown in the Eastern Counties, where the rainfall is relatively low. It has been supposed that England has not the natural conditions for wheat production, but this is not the case. The average yield per acre is 32 bushels, whereas that of the United States and Canada is about 15.

and in Australia a little lower. As regards quality, ordinary English wheat is soft, but "Yeoman" is hard, even with a high water content. Eighteen years ago the author grew some Duluth wheat and produced a hard grain, and subsequently, in collaboration with Sir Daniel HALL, showed that fertilisers could not improve the inherent quality of a wheat. Red Fife was grown successively for 25 years and gave good quality, but a low yield. Professor BIFFEN of Cambridge studied the question, with the result that "Yeoman" was produced, and recently "Yeoman II", and varieties are produced to suit conditions.

The present position is that English wheat will now yield flour in the highest degree suitable for bread-making, and in a few years the position of homegrown wheat in England should be very different from that which it has occupied in recent years.

500. **Italy: Home Colonization.** — Senator EDOARDO PANTANO, former President of the International Institute of Agriculture, introduced in the Senate on 20 January 1925 a bill by which it is proposed to found a National Institute for Home Colonisation, as a body corporate and under the immediate control of the Minister of National Economy. A statement of the objects of this Institute and the means for their furtherance is to be found in articles 2 and 3 of the scheme. By home colonisation is meant the utilization of the whole of the national agricultural assets by means of the direct or indirect intervention of the State. Villages are to be built in uncultivated or scarcely cultivated areas, lying remote from inhabited centres, whence farms of the small or average-sized type can be directly organized: small country towns can be formed in the neighbourhood of the well populated rural areas; thus making possible the scientific improvement of the small cultivator's holding. Agricultural co-operation and mutual insurance, the diffusion of small cultivating ownership or tenancy, or where possible the systematic cultivation of the latifundia are all to be encouraged: agricultural industries, stock-breeding, the building of farmworkers' houses are to be in every way promoted. The land improvements proper of lands either waste or inadequately cultivated are to be accompanied by improvements in water-supply and sanitation, and encouragement is to be given to all institutions which tend to the raising of the moral, intellectual and economic standards of life among the workers on the land.

Some account should be added of the means by which this great work of rehabilitation of the primary national wealth is to be carried out. Among the methods to be adopted are: the purchase of waste lands, or of lands unscientifically cultivated, or excessively broken up, with the object of reselling when improved, put into good order, and where necessary reclaimed, in lots which will form as many farm holdings of small or average size, cultivated directly by the owner or by his family; rural credit in all its forms, lightening of fiscal burdens and technical agricultural assistance both to the rural co-operative societies for purchase or renting of lands to be jointly leased or assigned among the members, and also to owners of large estates (latifundia). In the latter case, the result would be, according to local circumstances, to bring about either grants in emphyteusis of the estate, whether parcelled out or otherwise, or the cultivation or partial change in the system of cultivation of the land, the owner instituting such forms of associated labour as would allow for profit-shar-

ing. Support will also be given to all the different institutions and schemes mentioned in the bill as suitable for the furtherance of the objects in view. The proposal deals, in separate chapters, with grants in emphyteusis, loans on favourable terms, and fiscal facilities, the National Endowment Fund for the Institute, amounting to a milliard liras; agricultural notes and rural credit; the internal regulation of the Institute; the foundation of new villages and country towns; land purchases and expropriations; emigration, rural property belonging to the State, the provinces, the communes and corporate bodies; workers' co-operative societies and co-operative land-holding societies, families of ex-service men who are to receive lots for settlement; penal farm and reclamation colonies; rural credit; chemical fertilisers and farm implements; land settlement in Sicily and Sardinia; orchard cultivation; Parliamentary supervision and regulation. (*Per la colonizzazione interna.* Bill proposed by Senator EDOARDO PANTANO. Extract from the *Atti Parlamentari*, January 1925).

501. **Rumania: Agrarian Policy and Agricultural Production in Rumania.** — Under this title Prof. G. JONESCU-SISESTI, of the Higher School of Agriculture, Bucarest, and Director of the Rumanian Ministry of Agriculture, has brought together in a complete work five articles, which have already appeared in different reviews and deal respectively with: Rumanian agriculture in general, agrarian relations, the Rumanian agrarian reform and its consequences, co-operation in agriculture, and Rumanian agricultural production in comparison with that of the other Danubian countries. The chapter on agrarian relations gives a summary but precise historical account of the conditions of the rural population before and after the great reform of the abolition of serfdom, which was carried out in 1864, and was followed in 1866 by the "law for agricultural agreements", in virtue of which large landowners came to the assistance of peasants either by supplying them with land for farming, or providing cereals or money in exchange for services. This law, which virtually though indirectly re-introduced serfdom by its extremely harsh provisions, was amended in 1862 and again in 1882, but was only finally repealed in 1906, when it was replaced by new provisions regulating hiring agreements, rent-paying and produce-sharing tenancies. A new epoch is thus marked in Rumanian agrarian policy.

A point of departure is thus formed for the advent of the important recent reform of 1919, which freed the peasants completely from any dependence on the holders of the latifundia and in accordance with which Rumania became a country in which the small holding is the prevailing form of land tenure.

The author treats his subject exhaustively, explaining the full consequences of the agrarian revolution which took place and is still in progress in his country. He concludes by a comparative survey of the position of agriculture in Rumania, Jugoslavia, Bulgaria and Hungary. (G. JONESCU-SISESTI. *Structure agraire et production agricole de la Roumanie*, pp. 62, 8vo, Bucarest, 1924).

502. **Russian Requirements in Agricultural Machinery and Implements.** — According to figures of farm implements and machines supplied by the Soviet Government Stores the following percentages represent the number of applications for these requisites which it proved possible to meet in the first half of 1924, (that is to say the goods were supplied as against payment by in-

stalments): for ploughs 6.8 %, rapers 3.4 %, binders 6.7 %, reapers and binders 10.5 % mowers 9.5 %, threshing-machines 11.5 %, separators and churns for butter-making 5.3 %, sifters 3.8 %. Apart from the ploughs, the demand for agricultural machinery and particularly for harvesting machinery was much in excess of the supply. On the other hand the monopoly of the foreign trade made it impossible to introduce agricultural machinery from other countries. (SCHERMANN. Die russische Landwirtschaft. *Technik und Wirtschaft*. Year XVIII, Part I, 1924).

Miscellaneous Notices.

503. **Uniform International Analysis-Methods for Oils and Fats.** — Work in preparation for the international unification of the methods of analysis is proceeding in the special laboratories of a large number of States. An Italian Commission had already completed the work of collating the methods of analysing oils and fats and, on the occasion of the last Cogress of Chemistry at Milan had called a meeting of the principal representatives, both on the scientific and technical side, of the manufacture of oils, soaps and stearines, etc., with the object of laying the foundations of an international agreement as to the methods and principles by which the raw materials and the finished products of these industries should be judged. At this meeting the collection thus made in Italy was recognised to be for the moment the most complete and the most recent in existence. A similar Commission is now being organised in Germany, consisting of the representatives of the industry and of eminent scientists, with headquarters at the *Wissenschaftliche Zentrale für Oel und Fettforschung*. This Commission is making use of the Italian collection and also of special work accomplished in the different branches of industry and especially of the work of Dr. GOLDSCHMIDT on the analysis of the raw materials of the finished products of stearine manufacture and the reports of Dr. GREITEMANN on the manufacture of oils and edible fats. (*L'industria degli olî e dei grassi*, Year 1, Nos 11-13, 1924).

504. **Germany: Hydraulic Power in Bavaria.** — Among German States Bavaria is richest in water power. According to the *Wirtschaftsdienst* of Hamburg-Kiel (21 November 1924), which contains the figures of an enquiry made in this connection by the Bavarian Ministry of the Interior, the State should possess a hydraulic power utilised and utilisable of 1,330,000 kilowatts, that is an average of 2,000,000 H. P. of which about 500,000 are used. It is reckoned that, by the construction of the Rhine canal to the Main and Danube it should be possible to obtain 3,000,000 H. P., resulting in an annual yield of 12 thousand million kilowatt-hours equivalent to 12 million tons of ordinary coal.

505. **Austria: Water supply secured for a Mountain Pasture by Means of the Divining Rod.** — Prof. ALBRECHT, Director of the Agricultural School of Pyhra, describes the difficulty of watering the live stock in the Gahnweide pasture, which is entirely without springs though otherwise fertile and situated on a spur of the Schneeberg in Lower Austria. Efforts were made, by bringing rain water to the larger cowhouses, etc., to provide enough drinking water, and in years of heavy rainfall this plan was successful. In dry seasons, however, the stock suffered from thirst and had to be temporarily removed elsewhere. In the summer of 1924 an expert water-diviner went thoroughly

over the pastures and traced a vein of water at a depth of 7 metres. A well sunk on the spot proved sufficient; water was at once found at this depth, and the well was finally sunk to 10 metres, and even after four months of a dry season was full of water. A motor-pump was installed in the spring of 1925. (ALBRECHT. Die Wünschelrute im Dienste der Almwirtschaft. *Die Landwirtschaft*, Part 1, 15 Janury 1925, Vienna).

506. **Brazil: Cotton Standards.** — A special Committee, which met on 31 December 1924 at the headquarters of the *Associação Commercial* of Maceio (State of Alagoas, Brazil) has fixed three classes for the cotton of the North (do Norte): short, medium and long staple and each class in five types: 1. superior; 3. good; 5. moderately good; 7. fair; 9. inferior. The differential criteria among the three classes mentioned were established as follows: for the short staple (Mattas): 2 % between type 1 and type 3; 3 % between types 3 and 5; 3 % between types 5 and 7; 4 % between types 7 and 9. For the medium staple (Sertoes): 2 % between the types 1 and 3; 3 % between types 3 and 5; 4 % between types 5 and 7; 5 % between types 7 and 9. For the long staple (Seridó): 2 % between types 1 and 3; 3 % between types 3 and 5; 5 % between types 5 and 7; 7 % between types 7 and 9. The length of the staple is then determined in 22-28 mm. for the short staple; 28-34 mm. for the medium staple; 34 mm. and over for the long staple kinds. (*Boletim da Associação Commercial*, Year IV, No 123. Maceio, Estado de Alagoas, Brazil, 1923).

507. **Brazil: Rural Hygiene in the State of Rio de Janeiro.** — The *Serviço de Saneamento Rural* in Rio de Janeiro has published a report of Dr. MARIO PINOTTI on the prophylactic measures taken against malaria in the North of the State during 1924. A sketch map is attached and the report is also illustrated by graphs showing respectively the preventive use of quinine, the complete figures for the measures adopted for counteracting the effect of marshlands at Itinerante, Campos, S. João de Barra, Macahe and Itaparuna, the reduction in the malaria cases on two remedial sub-stations and the cost of the curative use of quinine. (Serviço de Saneamento Rural no Estado do Rio de Janeiro. *A campanha antimalarica no Norte do Estado em* 1924 by Dr. MARIO PINOTTI, 1924).

508. **Belgian Congo: The Albert National Park.** — In accordance with a decision reached between the King of the Belgians and the Minister of the Colonies there will be established in the northeast portion of the Belgian Congo at an altitude of 300 to 400 metres between Lake Kuon and Uganda a park in which the flora and fauna will be officially protected, and a royal decree will be issued forbidding hunters to enter the zone selected. (*Science*, Vol. LXI, No. 1574, 1925).

509. **Spain: Radiotelephony for the Diffusion of Information on the Breeding of Small Live Stock.** — A lecture given by Prof. GASPARE BALERIOLA on sericulture was broadcasted on 27 October 1924 from the *Radio-Ibérica* Hall in Madrid; on 29 October a lecture on poultry keeping by Dr RAMÓN J. CRESPO, technical director of the poultry farm belonging to His Highness the Prince of the Asturias, was transmitted, while on 3 November 1924 a third lecture was broadcasted with the object of diffusing information on beekeeping by Dr. TEODORO J. TRIGO, director of "*La Moderna Apicul-*

tura". These three lectures have been published *in extenso* in *La Industria Pecuaria*, Year XXV, No. 821, pp. 498-506, 1924, Madrid.

510. **France : The Cinematograph in Instruction on Poultry-Keeping.** — Professor VOITELLIER of the *Institut National Agronomique* has published a pamphlet on the principal breeds of poultry, the original feature being the 70 photographs accompanying the description taken from two films which VOITELLIER had prepared for purposes of giving instruction in poultry breeding. These two films are already in circulation and belong to the cinematograph service of the Ministry of Agriculture. There is also an official scheme for the preparation of a number of other films for educational purposes with a text in pamphlet form to correspond to each. The legends accompanying the screen pictures are on the one hand in some detail, so as to allow of their being used as a supplement to lectures or courses in poultry-keeping, while they are kept sufficiently short so as to avoid tedium. (*La Vie agricole et rurale*, Year 13, No. 40, 1924).

511. **Great Britain : Sugar Beet.** — The Government has decided to carry out the proposals respecting a subsidy, which will apply to sugar manufactured during the current season. The subsidy will be at the rate of 19s. 6d. per cwt. for the four years 1924-1928 ; at the rate of 13s. per cwt. for the three following years ; and at the rate of 6s. 6d. per cwt. for the three final years of the ten year period. These rates will apply to sugar of a polarisation exceeding 98 degrees ; for sugar of lower polarisations the rates will be reduced according to scale. The sugar factories will pay excise duty at the preferential rate, at present 9s. $8\,^2/_3$d per cwt.

Among the seven factories which it is proposed to construct, five will be erected in the course of 1925.

It will be a condition of payment of the subsidy that manufactures should pay during the first 4 years a minimum price of 44s. per ton of beet of 15 ½ % sugar content, with an addition or deduction of 3d. per ton in respect of each $^1/_{10}$ per cent of sugar content above or below 15 ½ %. (*Journal of Surveyors' Institution*, Vol. IV, Part 7, London, 1925).

512. **The History of the Sugar-Cane.** — According to an article in the *South African Sugar Journal* of 1924, the sugarcane did not come originally from the Western Hemisphere, but was introduced from Madeira in 1420 and into both North and South America after the voyage of Columbus. In North America it was cultivated for the first time about 1751 in the neighbourhood of the present New Orleans, by Jesuits coming from San Domingo. The first mention of sugar-refining in Louisiana dates back to 1758.

513. **A Series of Volumes on the South Australian Flora and Fauna.** — A series of *Handbooks of the Flora and Fauna of South Australia* is in preparation under the auspices of the British Science Guild, Section of South Australia. The work on the Flora has been carried out by J. M. BLACK except for the Orchidaceae, for which Dr. R. S. ROBERS is responsible. Up to the present only two volumes have been published out of the three which should cover the subject of systematic botany. In the first there is a short chapter which summarizes the history of the botany of South Australia, followed by a useful glossary of scientific terms. Keys are provided for the identification of the fam-

lies, genera and species, and the descriptive matter is accompanied by excellent illustrations.

This publication forms a valuable addition to the aids to study, which are of so much importance for students of botany and also of agriculture, and which illustrate in detail the vegetation of large tracts of the British Empire : they include the *Flora Capensis* of HARVEY and SONDER continued by Sir W. THISELTON-DYER ; the *Flora of Tropical Africa* of Prof. D. OLIVER, continued by Sir W. THISELTON-DYER ; the *Flora of British India* of Sir Joseph HOOKER, the celebrated author of *Icones Plantarum*, *Genera Plantarum*, and joint author of the great *Index Kewensis* for the phanerogams.

514. **Ancient Anglo-Saxon Manuscripts on Botany.** — In the *Journal of the Royal Horticultural Society* 1923, E. S. ROHDE gives a brief description of four manuscripts now in the British Museum and at present constituting all that remains in literary form of the botanical knowledge of the early English. These manuscripts are : the *Leech Book of Bald*, the *Lacnunga*, the translations of the Herbarium of Apuleius and the so-called *Peri Didaxeon*. (Quoted from the *Botanical Abstract*, XIV, No. 1, 1925).

515. **A New System of Carbonication of Plants.** — Attention has in recent years been called to the importance of carbon dioxide as a factor in vegetable growth, and various methods have been proposed of facilitating its assimilation by the plant. (See *International Review of the Science and Practice of Agriculture*, 1920 passim). A new method is now being proposed which combines simplicity and economy. The principle of this method consists in the employment of substances with high powers of absorption for atmospheric gases. These are to be sprinkled on the green parts of plants, so as to induce a more complete and rapid exchange of gases between the assimilating organs and the atmosphere. The author also refers to the anti-parasitic action of the substance suggested by himself and entitled « Vegetina ». The experimental treatment described shows that there is a stimulus to growth which may be inferred from the fuller development and better condition of the plant so treated (E. GNECCO. Esposizione di un nuovo sistema per aumentare lo sviluppo delle piante mediante un trattamento aereo e per renderle immuni da certe malattie. Rome, 1925).

516. **Italy : Protection of Typical Italian Wines.** — Avv. PIERO PAGANI, Deputy Procurator General at the Court of Appeal of Florence has published a comprehensive and detailed commentary on the Royal Decree-Law of 7 March 1924 for the protection of the " vino tipo " prefacing his remarks with a historical account of the protectionist systems in Norway, Sweden, South Africa, England, and Belgium, of the French and Portuguese systems, and of the effect of free trade on the Italian system. The author then discusses the detailed working of consortia in general and of wine-making consortia in particular, and after expressing a criticism of the system adopted in Italy, he explains his own views as to the practical application of the term " vino tipico ". (Avv. PIERO PAGANI. Il regime di " vino tipo " tutelato. Supplement to part 3 of the *Rivista di Diritto agrario*, pp. 479-511, Florence, 1924).

517. **Italy : State Quinine.** — The Ministry of Finance, Department of Patents, has published a special monograph on the progress made in the gov-

ernment production of quinine in Italy. The statement of results of this production, technical, economic, financial and industrial, are prefaced by a historical survey of the legislative and statistical aspects of the question. It is well known that the example set by Italy of the sale of quinine on the State account has been followed by other countries, including Greece, Bulgaria, Austria, Russia, Holland, and generally by all civilised peoples among whom malaria is prevalent. The problem of "paludism" has been since considered by the *League of Nations* to be a question of international hygiene, and a special Section for "Malaria" has been established at Geneva.

The Italian publication referred to may be said to be complete on the subject of government quinine. It contains an array of facts, supplemented by a number of plates which reproduce everything which may be regarded of importance connected with the industry, buildings, laboratories, etc. (Il Chinino dello Stato dall sue origini ad oggi — *Ministero delle Finanze, Direzione Generale delle Privative*, 4to, pp. 61. 15 plates, Turin 1924).

318. **Vine Growing and the Cinematograph.** — Good service in connection with the problem of the restoration of vineyards destroyed by phylloxera at Monferrato (Italy) has been done by cinematograph films on modern methods of vine-growing and on the grafting of vines on to American stocks, a practice which is being adopted with great advantage in this district. (*Il coltivatore*, Year 71, No. 2, 1925).

Journals and Reviews.

519. The *Zeitschrift für technische Biologie* has inaugurated a new series under the title of *Chemie der Zelle und Gewebe* a periodical on problems of fermentation, respiration and vitamines, edited by HUGO HAEHN (Berlin) and published by the Brüder Bornträger at Leipzig.

52·. *The "Kartoffelnummer" of the "Deutsche Landwirtschaftliche Presse".* — A special number of this old-established German agricultural periodical is dedicated exclusively to potatoes. It contains a number of illustrations and a chromolithographic illustration representing fifteen varieties of potato tubers, which are resistant to black scab. The potato plant is treated from every point of view by scientists and experts and the result is a valuable collection of information particularly important to agriculturists. (*Deutsche Landwirtschaftliche Presse*, 53, No. 7, 14 February 1925).

321. The Centenary of the *Allgemeine Forst- und Jagdzeitung.* — In the *Forstwiss Centralblatt* (XLIV, No. 173, 1924) the history of this periodical from its foundation to the end of 1924 is described.

522. The review *Technik und Wirtschaft*, the monthly journal of the Association of German Engineers, devotes a special number, January 1925, to Russia, designed as far as possible to make known in Germany the economic conditions of Russia especially in view of the economic relations which may be formed between the two great countries. With this object the editors have invited persons, specially qualified as having for some years followed the Russian economic movement, to contribute special articles. An introductory article by Dr. SCHERMANN (Berlin) deals with ordinary living conditions in Russia, housing, food, clothing, etc. Dr. S. VON OLDENBURG (Berlin) discusses the political

constitution and the Soviet finances, and E. von FALKOWSKY, vice-president of the Association of Russian Advocates in Germany, the Soviet legislation. SCHERMANN also deals with labour questions and in a lengthy article on Russian economic conditions surveys first agriculture and then industry, while the subject of trade is discussed by an anonymous Serbian author. The whole forms a booklet of 48 pp. in large 8vo with statistical tables and diagrams.

523. "*Producción*", a review of agriculture, industry, stock-breeding and engineering, which is published in Madrid, has devoted one number (Year VI, No. 99, 1924), with copious illustrations, to the Seventh International Congress on Olive growing in Seville. It includes the report presented by M. D. FRANCISCO BILBAO Y SEVILLA, Delegate of Spain to the Permanent Committee of the International Institute of Agriculture and by M. D. JOSÉ MARIA de SOROS, attached to the *Consejo Agronómico de España*, on the statistics of production, consumption, import and export of olive oil in the different countries. The report is illustrated by explanatory diagrams and by numerous statistical tables.

The different pavilions of the Exhibition of Olive growing are also described, and special emphasis is laid on the modern improved oil manufacturing plants which go far to make Spain one of the richest countries in this particular industry.

524. *El Crédito Agricola* is the title of a new monthly agricultural review, which was inaugurated at Madrid in January last under the editorship of J. G. NAVARRO. One of its features will be the publication, in the form of a separate appendix to the periodical itself, of the official regulations which may be of interest to readers. In this way the Law on agricultural unions and the consequential regulations (*Ley de sindicatos agricolas, Reglamento de los mismos*) has already appeared. Editing and Managing Office: Madrid, *Pilar* 18. The first number contains among other matter, the draft scheme for the *Instituto de Crédito Agricola*, the capital of which is to be 100 millions of pesetas 75 millions given by the State and repayable by instalments, the remaining 25 supplied by the agricultural associations.

525. The *China Chemists' and Druggists' Review* is a new Chinese periodical of Chemistry and Pharmacy which appears every month in Shanghai in two languages, English and Chinese.

526. The ROCKEFELLER Foundation has assigned 350,000 dollars to the review "*International Biological Abstract*".

527. A new periodical for the oil and fat industry is announced under the title of the *Journal of Oil and Fat Industries*, under the auspices of the *American Oil Chemists' Society*. Editor: B. S. BAILEY, Savannah, Georgia, U.S.A.

528. *The India Rubber Journal*, the oldest established periodical in connection with rubber cultivation and manufacture, celebrated its fortieth anniversary in 1924, and published a special double number on the occasion.

529. "*De Indische Cultuur*". — Under this new title is combined the 14th year of the old-established review *Teysmannia*, and the tenth year of the *Ned. Ind. Rubber- en Thee Tijdschrift*, which is published at Soekaboemi (Java). Although different agricultural topics, cultivation of tobacco, tea, sugar cane, coffee, etc., are dealt with in special reports of the Experimental Station of the

Dutch Indies, *De Indische Culturen* will have a large range of its own to cover in all the other branches of tropical agriculture.

530. A *Bibliography of Polish Botany* has been published (*Polska bibliografia botaniczna*) in the Acta Soc. Bot. Poloniae of 1924.

Personal.

531. The library and the collection of plants belonging to Mr. J. P. ALDERSON of Juneau, Alaska, a well-known student of the Alaskan flora, who was preparing a work on the mildews which attack the vegetation of that region, was completely destroyed by fire on 12 November 1924.

532. In the *Journal of Botany* (LXIII, No. 745, 1925) there is an obituary notice of CHARLES BAYLEY, member of the Linnean Society and honorary Doctor of Science of the University of Manchester. BAYLEY bequeathed to the University his valuable herbarium, containing specimens collected by himself and catalogued also by himself in two manuscript volumes, compiled in a period of fifty years. He also left the University his library, containing not only botanical works but also works on other branches of science with special reference to Palestine, Egypt and Chaldea. He founded at Manchester a small association of enthusiasts for microscopic research work called the "Leeuwenhoek Club".

533. In the *Tharandter Forstliches Jahrbuch* (LXXV, Part VI, 1924) an account is given of the writings of RICHARD BECK, who died on 18 November 1923 and had been for nearly 30 year Professor of Forestry at Tharandt. Besides numerous original contributions to the literature of forestry, some of which gained prizes, together with his memoir on the re-afforestation of areas belonging to small agricultural holdings uneconomically cultivated from the point of view of agriculture and forestry, which took the Reuning Foundation Prize, he undertook the revision of several manuals. The part dealing with forestry in the third and fourth editions of the LOREY-WAGNER manual (*Handbuch der Forstwissenschaft*) is his work, and the revised edition of the well known treatise by HESS (*Lehrbuch über den Forstschutz*) appeared in the fourth edition under the name HESS-BECK.

534. Dr. HORACE TABBERER BROWN, well known for his important work on ferments died recently at the age of 70 years.

535. Dr. G. A. DEAN, Professor of Entomology at the *Kansas State Agricultural College*, was recently elected President of the *American Entomological Society*.

536. On 8 February of last year the death took place at Carlsruhe of the Privy Councillor Prof. CARL ENGLER, a chemist of world-wide celebrity, especially for his investigations into the chemistry of the petrols and the processes of auto-oxidation. A biography of ENGLER was published on the occasion of his eightieth birthday in 1922 by Dr. F. HABER in the *Chemiker Zeitung*.

537. Dr. FRANZ E. GELDENHUYS has been recently appointed by the Minister of Agriculture of South Africa chief of a new division of agricultural economics and markets in the Department of Agriculture.

538. The death of Baron MAURICE GERARD was announced in December 1921. He was a member of the *Académie d'Agriculture* and one of the founders

of the Norman Herd-book and his stock-breeding farm of Maisons near Bayeux (Calvados) was considered a model. Baron GERARD instituted at the *Académie d'Agriculture* a permanent foundation of 2000 francs yearly for the benefit of French stock-breeding. For more than 30 years he devoted himself to selective breeding of the Norman breed of cattle, and his herds constantly brought him credit in competitions.

539. In Miss LILIAN SUSETTE GIBBS, plant ecology has lost a keen investigator. Her work on the mountain flora of Australasia and on questions of the geographical distribution of plants was well known to the scientific world.

540. GOTTLIEB HABERLANDT, the eminent plant physiologist, who investigated the " sense organs " of plants and founded the theory of vegetable " hormones ", has celebrated his 70th year. In *Naturwissenschaften* CORRENS has published an excellent biographical memoir of HABERLANDT.

541. Dr. L. J. HARRIS, of the School of Biochemistry at Cambridge, has received the *Meldola Medal* from the Council of the Institute of Chemistry for his work on the chemistry of the proteins.

542. Prof. ALEXANDER HERZFELD, the Privy Councillor, who has from 1887 been at the head of the Berlin *Institut für Zuckerindustrie*, has completed his 70th year. This Institute which has a world wide reputation was formed from the private laboratory of SCHEIBLER, and the credit for its organization belongs to HERZFELD. His work on the analyses, the separation, saturation and solubility of sugar and on sugar inverts takes a place among the most modern researches on the subject.

543. RICHARD IRWIN LINCH, for forty years curator of the University Botanical Garden at Cambridge, died on 7 December 1924 at the age of 74.

544. Dr. E. E. KLEIN, Fellow of the Royal Society, London, who died recently at the age of 80 was a pioneer in normal histology and one of the founders of modern bacteriology.

545. Prof. GIUSEPPE LO PRIORE has been transferred to the Chair of Botany of the Portici Higher Institute of Agriculture (Naples).

546. The Canadian Society of Technical Agriculturists at its last annual meeting at Guelph Ontario, conferred honorary membership of the Society on Mr. W. T. MACOUN, a horticulturist in the Dominion since 1910, for professional merit.

547. The meeting of 19 January 1925 of the *Académie des Sciences* at Paris was suspended owing to the death of one of its members, Prof. LEON MAQUENNE, the former pupil of DEHERAIN, and successor of VILLE in the chair of Plant Physics, holding in addition later that of Plant Physiology and succeeding DUCLAUX in the *Académie des Sciences*. His work on sugar, the respiration of plants, and the part of certain minerals in vegetative life is well known. By preparing carbide of calcium and other carbides he anticipated in some degree the discoveries of MOISSAN.

548. The death of Dr. JAMES MILLS, president for 25 years of the Ontario Agricultural College, is announced.

549. Dr. R. K. NABOURS, Chief of the Department of Zoology in the Kansas State Agricultural College, has been elected a member of the Advisory Committee of the Eugenics Commission of the United States.

550. By the death of KARL FREDERIC OTTO NORDSTEDT, the eminent algologist, Sweden has lost one of her most renowned botanists. A list of more than one hundred books and articles published by NORDSTEDT is given by Dr. GERTZ in the *Botaniska Notiser* and extend over a period of scientific activity of more than 60 years. The most important refer to the algae and the *Index Desmidiacearum nordstedtiano*, published in 1896, was for a long time the model of its kind. Apart from the great master of the subject, ALEXANDER BRAUN, no one had so great a range of knowledge of the *Charophytae* as the lamented Swedish botanist. He was for forty years attached to the Lund Botanic Institute.

551. Prof. J. K. RAMSBOTTOM died at New York on 2 February 1925. He was well known in scientific circles for his work in mycology and in connection with bulbs. His research work on the "Eel-Worm Disease" of bulbs gained for him in 1912 the gold medal of the Royal Horticultural Society, and there is no doubt that as a result of his work very serious damage to the bulb industry was averted.

552. The Italian Association of Hygiene, on the occasion of its annual meeting, is proposing to present a gold medal to Dr. A. SCLAVO, Professor of Hygiene at Florence, in tribute of his services in the cause of hygiene in Italy.

553. By W. G. SMITH, in *Nature* (113, 683-684 ; 1924) there appears a monograph on Prof. J. E. B. WARMING, who died on 2 April 1924 and whose work has had an important influence on botanical writings in general. He was especially known for his ecological publications and it is probable that more than half of the 3000 works referred to in the last edition of his manual on ecology were inspired and influenced by his own work. WARMING's contributions to botanical literature extended over more than 60 years. He was born in 1841 in Jutland and was professor of Botany at the University of Copenhagen from 1885 to 1911.

554. The death on 30 January 1925 of WILLIAM WATSON has recently been announced. He was formerly curator of the Royal Botanic Gardens at Kew, and possessed an unrivalled knowledge of tropical and sub-tropical botany and was equally an expert in horticultural questions.

555. Another well known scientist, JAMES ALFRED WHELDON, who died on 28 November 1924 will be remembered for his valuable contributions to botanical studies and particularly for his work in biology. His publications on this subject are very extensive and appeared in the *Naturalist*, the *Lancashire Naturalist*, the *Transactions of the Liverpool Botanical Society*, etc. His *Synopsis of the European Sphagna* is well known, and also his very important work on the *Flora of West Lancashire*.

Dott. GUIDO BORGHESANI, *direttore responsabile*.

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CURRENT NOTICES.

NOTE. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

The Editors notes are marked (*Ed.*); the letter *R* indicates the references to the foregoing issues (Monthly and Quarterly) of the International Review.

ORIGINAL ARTICLES

THE PROPAGATION OF CRYSTALS IN A SUPER-SATURATED SOLUTION (1).

In a previous article (New Theory of Solutions) were stated what I consider to be the laws relative to the process of crystallisation and dissolution, based on the results of my experimental work in this province. A promise was made to treat at an early date in a more detailed manner a series of questions which were only touched upon in that article, and to give further explanations, after having placed in order the materials which had obtained from the experiments.

The present article is the first of this supplementary series and deals with the question of the propagation of the process of crystallisation in a supersaturated solution.

In the previous article it was stated that the general crystallisation of a supersaturated solution seems to be the result of the division of a pre-existing crystal. How should this be interpreted? According to my conception of the process of crystallisation, a decrystallised and supersaturated solution can scarcely crystallise spontaneously. To make it crystallise, at least one single crystallon of the supersaturated matter must be introduced.

Logically, the application of this principle raises another question, which may be formulated as follows: Suppose we have, in an enclosed space, a certain quantity of decrystallised and supersaturated solution. By some means a single crystal has been introduced into it. The solution crystallises. How is this total crystallisation

(1) See Prof. J. A. Kucharenko, New Theory of Solutions. *R.* Vol. III, No. 1, 1925.

brought about? Is it the result of a molecular and so to speak catalytic influence through the presence of the crystal, or is it caused by the ultramicroscopic particles (the crystallons) which detach themselves from the crystal introduced and which become so many centres for all the crystals in process of formation? In order to examine this question the following series of tests were made. Solutions of potash-alum were prepared in round glass bowls (crystallisers) with their edges turned down vertically, the solutions being supersaturated and decrystallised. This substance was chosen on account of its comparatively rapid crystallisation. In order to completely isolate the crystallisers they were covered with stout and compact Swedish filter paper, and tied with string. This precaution was sufficient to prevent the solutions, prepared at a high degree of supersaturation, from crystallising in a laboratory artificially impregnated by myriads of microscopically small crystals.

The crystalliser being thus protected and containing a supersaturated and decrystallised solution of alum, and the protective paper cover being taken off in a laboratory previously impregnated with 0.5 gm. of crystal alum, ground to a fine powder, a few minutes suffice to cause the total crystallisation of the solution. The microscopic particles of alum, transformed into powder, are distributed very uniformly in the atmosphere; from this it may be supposed that the whole surface of the crystalliser will become covered with perfectly equally distributed crystals.

This supposition was confirmed by the result. Fig. 106 (Table LI) represents a photograph taken from above. By the side of the crystalliser is a reduced scale (in centimetres) giving the natural size of the bowl, the crystals and their distribution over a unit of surface.

If the conditions of contact (infection) be then changed by causing crystallisation by means of a single crystal placed in the centre of the crystalliser, the process of crystallisation proceeds quite differently, as shown in Figs. 107, 108, 109. If the crystal placed in the centre of the crystalliser, filled with a supersaturated and decrystallised solution, acted as a catalyser of crystallisation, it would cause a general crystallisation not differing from that shown in fig. 106.

How then does a crystal act which is introduced into a supersaturated and decrystallised solution, and how is the process of crystallisation propagated in the second case, *i. e.* where contagion comes from a central crystal? Numerous experiments were made with solutions of different degrees of supersaturation, and in a great number

PLATE LI.

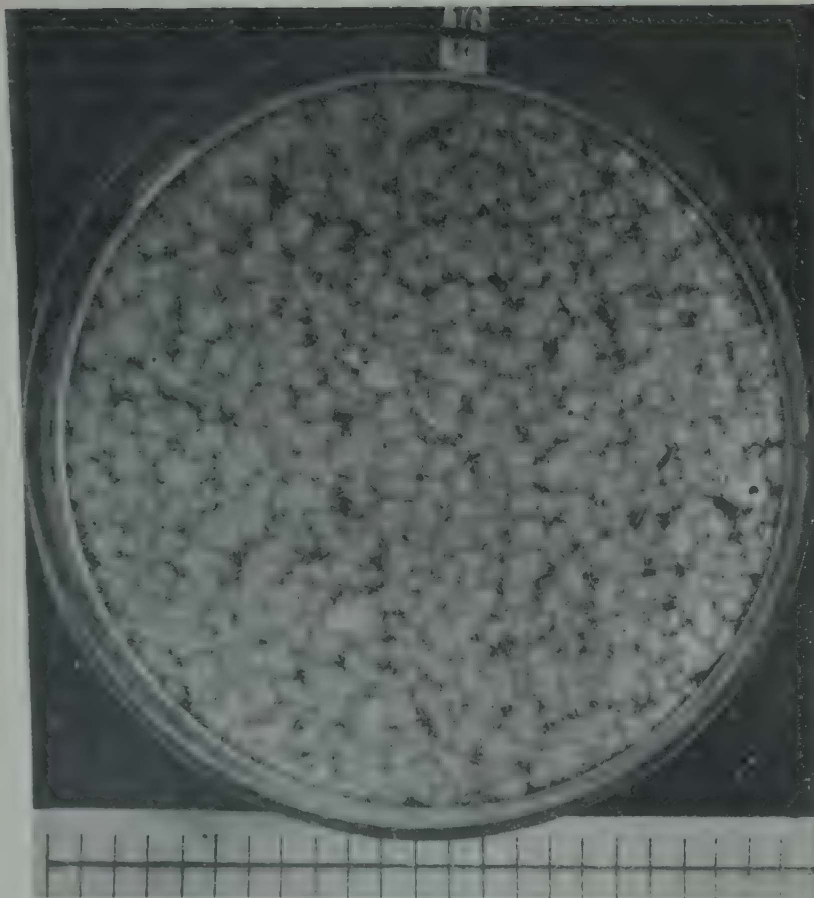

FIG. [illegible]. — A decrystallised solution of alum, containing 40.0 % of $K_2SO_4Al_2(SO_4)_3\,24H_2O$. After having impregnated the atmosphere of the laboratory with powdered alum crystals, the crystalliser was opened for 10 minutes. When the crystallisation was finished, the crystalliser was photographed. The even distribution of the crystals over the whole surface of the crystalliser will be observed.

FIG. 107. — A decrystallised solution of alum, containing 20.1 % $K_2SO_4Al_2(SO_4)_3\,24H_2O$. Crystallisation is induced by placing a crystal in the centre of the crystalliser. The photograph was taken on the termination of the process of crystallisation. It will be seen that the number of crystals decreases as the distance increases from the centre of contagion.

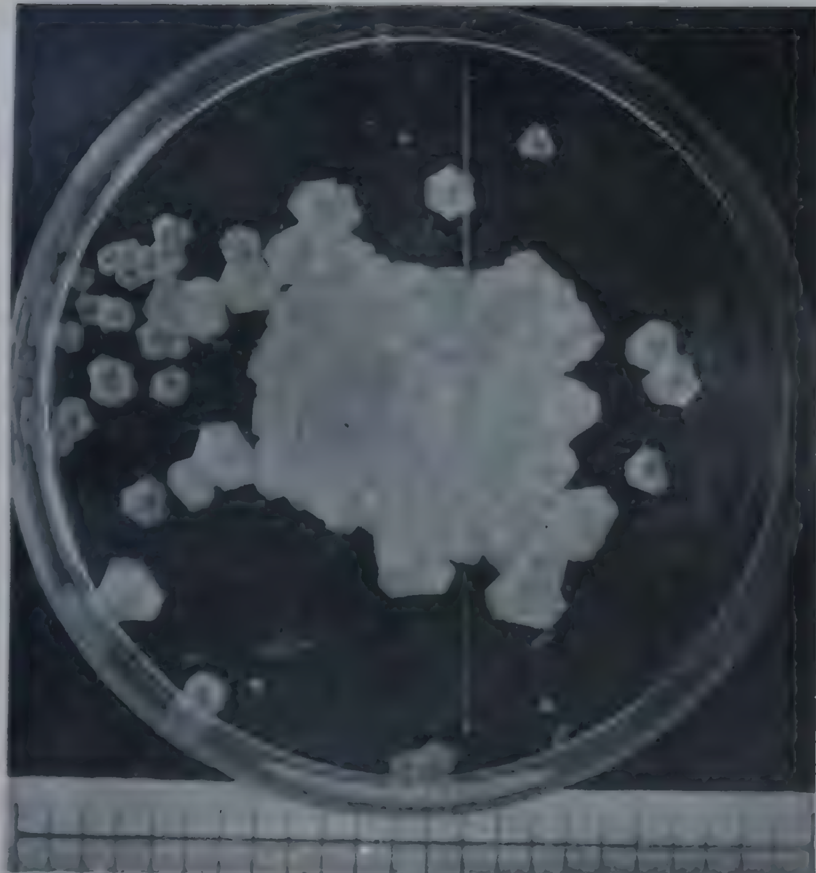

FIG. [illegible]. — A supersaturated solution of alum, containing [illegible] of $K_2SO_4Al_2(SO_4)_3 \cdot 24H_2O$. Crystallisation is brought about by placing a crystal in the centre of the crystalliser. The photograph was taken on the termination of the process of crystallisation. Owing to the considerable supersaturation, the crystals at the centre have united on increasing, without however losing their individual contours. At the periphery the crystals increase in size separately, owing to the greater distance which separates them one from another.

FIG. [illegible]. — A supersaturated solution of alum, containing [illegible] of $K_2SO_4Al_2(SO_4)_3 \cdot 24H_2O$. Crystallisation is brought about by placing a crystal in the centre of the crystalliser. The photograph was taken on the termination of the process of crystallisation. The size of the crystals is further increased by a greater supersaturation, as a result of which the crystals in the centre have lost their individual contours.

of cases photographs were taken. The results justified us in affirming in the previous article (New Theory of Solutions) the hypothesis laid down as to the mechanism of the process of crystallisation, and which will be developed on the following lines:

A crystal, introduced into a supersaturated solution, begins to accumulate on itself the matter it draws from the layer of solution with which it is in direct contact. The concentration of this layer consequently decreases and currents of concentration are formed which mechanically carry along with them ultra-microscopic particles of crystals (crystallons). The latter disperse more and more around the central crystal, forming additional centres of crystallisation.

If the supersaturation is not considerable (fig. 107, 10.1 %) the process of crystallisation terminates before the crystals succeed in rejoining one another while increasing. If, on the contrary, the supersaturation is considerable, the separate crystals unite into a single one (fig. 4, 45.4 %). Fig. 3, with medium super-saturation (29.8 %) represents an intermediary stage between those of figs. 2 and 4: in the centre the crystals have united in their growth, without, nevertheless, having lost their contours; in the periphery the crystals remain separated.

On examining figs. 107, 108, 109, it will be observed that as the distance increases from the central crystal, the crystals formed diminish in number progressively. The decrease in the number of crystals detached and the degree of their dispersion becomes greater with the weakening of the intensity of the currents of concentration. The causes which bring about this weakening are, for instance, the influence of a substance of which the speed of crystallisation is insignificant, or that of an increase of viscosity, or again of the decrease of the layer of solution.

This deduction explains the phenomenon observed, that, by taking some precautions against outside contagion, at a low temperature separate crystals of saccharose can be increased in a solution of saccharose considerably supersaturated and viscous, without causing a general crystallisation of the whole solution. Evidently the currents of concentration set up in this case are so weak, that they are not sufficient to detach the crystallons from the crystal and disperse them in the solution.

Thus then, the examination of the propagation of crystals in a superaturated solution lead to the conclusion that, a total crystallisation of supersaturated solutions is caused by the division of a pre-

existing crystal, in the absence of which crystallisation is impossible. The influence of the currents of concentration of the crystal and the rubbing of the crystals one against another may be indicated as the causes of the particles detaching themselves from the pre-existing crystal and afterwards forming centres for the total crystallisation.

Whether they are the only causes which determine crystallisation, or whether there are others which have not been taken into account, is a question which remains still to be examined.

The investigations are being continued, and an account of them will be published as soon as definite results are obtained.

Prof. J. A. KUCHARENKO,
Director of the Institute of Scientific Research on the Technology of Agricultural Industries, Kieff, (Ukraine).

ALUMINIUM IN ORGANIC LIFE.

After oxygen and silica, aluminium is the most widely disseminated element on our planet and forms one of the chief constituent parts of the earth's solid crust. It is maintained that aluminium is not absorbed by plants, and if present in the organism only forms an accessory constituent part of the cells and is of no importance as regards the structure and plant metabolism.

Mention may be made here that many tests have been carried out by various investigators on certain crops, without the factors under which plants in a natural state develop having been taken into consideration. My investigations and those of my collaborators have shown that an important role and physiological function are to be attributed to aluminium in certain families of plants (1).

We observed that all plant organs of the xerophytes, *i. e.* plants which prefer dry surroundings, which live on the sandy sea-shore, in the steppes, prairies and desert, and are provided with protective apparatus against desiccation, are disinguished by a low aluminium content. The hygrophytes, on the contrary, which prefer or grow in water, are notable for a high aluminium content. Cryptogams especially, for instance, algae, show a marked aluminium content in their dry matter.

From the whole plant-life economy of the hygrophytes it is perceived that the absorption of aluminium from the water or soil is a special need. Among them there predominates a particular preference for aluminium, which concentrates in the roots, rhizomes, tubers and bulbs of the more highly organised plants. The aerial part of these plants always contains less aluminium than the subterranean parts. Aluminium is also stored up in the reserve matter of

1) A detailed work by JULIUS STOKLASA on the dissemination of aluminium in nature and its importance to the structure of plants and to plant metabolism has been published by Gustav Fischer, Jena. This work has aroused keen attention throughout the scientific world. (*Ed.*).

their seed. The salt-plant family (halophytes) also show large quantities of aluminium in the root system.

In the case of the mesophytes, the plants which prefer air and soil of medium moisture, it was found that in those which developed in dry places, both the roots and aerial part were exceedingly low in aluminium. But those plants which had grown up on a wet marshy soil had, especially in the roots, stored up large quantities of aluminium.

From all the observations made it was concluded that in plants which more or less prefer moisture, a specific porosity of the cells of the radical system exists, also that special reactions of the plasma colloids take place, as well as chemical processes of the plasma constituent parts of aluminium.

There are great quantities of iron compounds in the soil, and accumulation of iron in the cells of the radical system causes plasmolysis (cell destruction) and the gradual dying-off of the plant. When aluminium compounds are present, however, plasmolysis does not take place; the aluminium combines with various bodies in the cell sap and hinders the entrance of iron and manganese compounds into the cells. We look upon this phenomenon as a very important physiological factor of aluminium in the structure and in the metabolism of plants, consequently this element forms an indispensable constituent part of those plants which prefer water and which do not thrive in a soil rich in iron.

If the plant is in a nutrient medium rich in iron and which therefore contains more iron than the plant needs for its development, the accumulation of the excess of iron causes disturbance in the cells because the plant finds no use for large quantities of iron in its first period of growth. But when aluminium is present, it hinders the entrance of the iron into the radical system and thereby protects the plant.

Aluminium also possesses the interesting property of participating in the *formation of the colouring matter* of the flowers. Our investigations led to the discovery of the fact that aluminium, with iron and manganese, has a great influence on the colouring matter dissolved in the cell sap. These three elements not only increase the intensity of the colouring but also cause *changes in the latter*, white and pink flowers becoming red, and possibly violet or blue, and yellow ones changing to red.

In the animal world also an important part as regards colouring is attributed to aluminium. Our tests show that both in beetles and

birds, where blue, violet, red and blue-green pigments are present, the aluminium content is greater than in the case of the other pigments. It is certainly an interesting parallel that nearly all the plants which prefer dry surroundings, the flowers of which are poor in aluminium, or contain none at all, are *white or yellow in colour.* Surely there is a connection between the plant and animal kingdoms as regards the formation of bright pigments!

An observation of aluminium in the mineral kingdom leads to the conclusion that it is found in the brightest gems. Its compounds are found for instance in corundum, ruby, sapphire and oriental amethysts, emeralds, etc., in which these compounds cause the brilliant colours.

An observation of *colour formation in the mineral, plant and animal kingdoms* leads to the discovery that aluminium plays a mysterious part in the formation of the bright colours of nature. It is taken up from the soil by the roots of plants, and through its agency magnificent red, blue and violet flowers are formed. The plants serve as food for animals, and when aluminium thus enters the animal kingdom, it participates in the formation of the delicate and beautiful colours of animal organisms. That aluminium besides iron is also present in animals' blood was shown by our analyses.

Not less important was the rôle of aluminium in the *vital processes in the past.* If we glance at the plant life of former ages, the impression is gained that the flora of those times developed under especially favourable conditions, attaining a luxuriance of which we to-day can with difficulty imagine. The plant world which yields us the coal in use to-day, developed in extensive marshes and morasses, under a mild, equable climate, free of frost, and in over-grown flat lowlands and the banks of waters having a soil rich in organic matter. Those plants which absorbed the moisture were mostly cryptogams.

The fossil cryptogams, like shave-grass, club moss and ferns, were, and are, plants which absorb comparatively large quantities of silica, aluminium and iron. In general it may be said that the absorption of nutrient matter, and the whole structural and metabolic process in a large number of fossil and living cryptogams, proceeded and proceeds quite differently from that of phanerogams. The former, especially peat moss (sphagnum), avoid nutrient substances containing phosphorus, potash and possibly calcium.

In soil where peat moss and similar plants abound there is a slightly

acid reaction, through which the injurious influence of hydroxylions is entirely excluded; here the nutrient medium contains iron and aluminium in large quantities, also sulphur in the form of iron sulphates was met with in large amounts. To aluminium fell the task not only of inhibiting the injurious influence of iron on the plant organism, but also to check the reabsorption of potash and phosphorus in order to protect the normal exchange of energy and matter. Aluminium consequently regulated the absorption of the ions only, through the radical system of the plant, in the earlier periods of the earth's history, for which purpose it was present in the soil under the predominating form of humates. The flora of those times, which formed the extensive coal seams, had no great need of phosphorus and potash, and were satisfied with the elements which exist in large quantities in the soil, viz., silica, aluminium and possibly lime. As our tests showed, a large accumulation of potash and phopshorus might have been injurious to the plant growth of those times. That this was not so, and that the early flora developed in great luxuriance, is due to the physiological influence of aluminium, from which it may be concluded that, to-day, *without aluminium there would be no coal.* It must also be remembered that the enormous plant development which produced our pit-coal and lignite, was rendered possible by exceptionally favourable growth conditions and *high radio-activity* of the soil and atmosphere. Also note that the flora of the different geological epochs, the rocks of which show high radio-activity, attained enormous dimensions, contrary to that of the chalk formation, for instance, which shows no radio-activity and in which no coal was formed.

The early flora, especially the cryptogams, were able to obtain the aluminium and silica necessary for the changes in their structural matter, besides the other vital elements. Through the intensive respiration processes of these plants, which lived in community with fungi and bacteria, enormous quantities of carbonic acid were produced. In the decomposition processes of organic matter, large quantities of organic acids were also formed; these two agents then brought about the formation of china clay, of the volcanic rocks and crystalline schists, slowly but surely, and produced a very suitable nutrient medium for the development of the cryptogams. These elementary phenomena and processes afford us a glimpse into the fundamental function of aluminium in the great storehouse of nature.

In the present age aluminium plays an important part in soil

reaction. DAIKUHARA (1) first called attention to the fact that if calcium chloride be added to a soil which is poor in lime and rich in aluminium, iron-oxide and silicic acid, the following reversible processes take place:

$$\begin{aligned}
Al_4(SiO_3)_3 &+ 12\ KCl \rightleftarrows 3\ K_4SiO_4 + 4\ AlCl_3 \\
AlCl_3 &+ 3\ H_2O \rightleftarrows Al(OH)_3 + 3\ HCl \\
K_4SiO_4 &+ 4\ H_2O \rightleftarrows 4\ KOH + H_4SiO_4
\end{aligned}$$

The American authors VEITCH (2), L. HARTWELL and F. R. PEMLEER (3), and CROWTHER and RUSTON (4), expressed the opinion that the free hydrochloric acid formed has a poisonous effect on the root system of the plant, and H. KAPPEN, basing on this reaction, suggested the so-called *soil acidity exchange*, and this acidity is now being determined by the colorimetric and electrometric methods in the reversible process, which takes place on the addition of calcium chloride to the soil.

H. KAPPEN (5) expressed the opinion that these exchangeable-acid soils have a particularly injurious effect on crops, owing to changes which occur with the salts used in fertilising, in conjunction with aluminium salts, which, both on account of their acid nature and their aluminium content, are injurious to plant growth. The sensitiveness of crops to this form of soil acidity is by no means equally great in all cases. Barley, turnips, red clover, peas, beans and lucerne, also mustard, according to KAPPEN's growth tests, suffer considerably under this form of acidity; while oats, maize, potatoes, serradella and yellow lupins bear a comparatively high degree of exchange-acidity fairly well.

The physiological and biochemical tests which we have made, both in the hothouse and in the experimental field, with an application of 1-8 q. of aluminium chloride and aluminium sulphate per ha. (which was worked into the soil to a depth of 20 cm.) do not confirm KAPPEN's opinion, for the aluminium chloride and aluminium sulphate, in quantities of 4-6 q. per ha., had no injurious effect when used on barley,

(1) G. DAIKUHARA. *The Bull. of the Imp. Agr. Exp. St. Japan*, 1914, 1; Jahresber f. Agrikulturchemie 55, 1914.

(2) *Journ. of the Amer. Chem. Soc.*, p. 637. 1904.

(3) Report Agric. Exp. Stat. Kingston, R. S. 1907.

(4) *Journ. Agric. Sci.*, 4. pp. 25-55, 1911.

(5) H. KAPPEN. On forms of soil acidity and their importance in plant physiology. *Landw. Versuchs-Stat.* Verlagsbuchhandlung Paul Parey, Berlin, [illegible]

wheat and turnips, nor on red clover, peas, beans and lucerne, nor mustard.

We further found by our tests that the aluminium chloride and aluminium sulphate in the soil have not such a toxic effect as in the artificial nutrient solutions in water cultures. There is a great difference in the toxic effect of aluminium in artificial nutrient soutions and in the soil. The water culture tests proved that even by the use of 0.002 atomic weight of aluminium per litre of nutrient solution, a decrease in the production of vegetable matter was observed. This concentration corresponds to 0.267 gm. anhydrous aluminium chloride per litre, and 6.0 cc. of 0.1 normal soda is required to neutralise 100 cc. of this solution. By further tests it was found that the aluminium-ion, in the form of aluminium sulphate, in a concentration of 0.005 atomic weight per litre of nutrient solution, caused a great decrease in plant growth: 0.006 atomic weight of aluminium in the form of aluminium sulphate was likewise very injurious to the growth of all plants. With 0.0085 atomic weight of aluminium in the form of aluminium sulphate per 1 litre of nutrient solution, *Hordeum distichum*, *Triticum vulgare* and *Secale cereale* died after 36 days. *Polygonum fagopyrum* and *Avena sativa*, showed poor but continuous growth. With 0.01 atomic weight of aluminium in the form of aluminium sulphate, all plants died after 19-24 days.

It was found that in soils containing only 0.1 % of calcium oxide and 2.2 % of carbon in the form of organic matter, 0.04-0.05 gm. of aluminium in the form of aluminium chloride per kg. of soil, had no toxic effect on the growth of barley, wheat, rye, oats, red clover, lucerne, beans, turnips, potatoes and maize. Only when the quantity of aluminium in the form of aluminium chloride rises to 0.06 gm. per kg. of soil, is a depression observed in the initial growth stage of barley, wheat, red clover, lucerne and turnips; a slight toxic effect from aluminium chloride was especially observed on clover and turnips. Aluminium in the form of aluminium sulphate at a concentration of 0.06 gm. of aluminium per kg. of soil had no injurious effect on any crop, on the contrary it even had a stimulating effect on oats, rye, maize and potatoes.

The richer the soil in decomposed organic matter, the stronger is the combination of aluminium sulphates and aluminium chlorides which can be used without any injury to plant growth.

All the plants on which pot growth tests, were made take up aluminium in larger or smaller quantities when it is applied in an

assimilable form; this applies not only to the soluble aluminium salts, but also to certain aluminium compounds insoluble in water.

In the water growth tests, on the contrary, the soluble aluminium salts, even when greatly diluted, though in specifically unequal degrees, have an injurious effect on the growing roots. From our experiments it is concluded that specific permeability exists in the root system of the plants, and also that specific reactions of the plasma colloids take place and that chemical processes of the plasma constituent parts take place under the influence of aluminium. The whole mechanism of the absorption of aluminium is connected with the exchange of cations. The stopping of the absorption of the antagonistic cations, i. e. the reciprocal reduction of the absorption of manganese or iron, was clearly proved by our tests.

Field, garden, meadow and forest soils, however, removed strikingly large quantities of soluble aluminium salts and aluminium chloride. Certain small quantities of aluminium salts may indeed have a stimulating effect on plant growth. Aluminium sulphate and aluminium chloride have considerable poisonous influence on field, garden, meadow and forest soils.

It should be remembered that aluminium in the form of aluminium chloride and aluminium sulphate, in the soil have different effects on plant production than in the case of water cultures. The reciprocal chemical exchange processes in the soil give rise to various reactions, which naturally exert an influence on the production of vegetable matter.

Why in the presence of aluminium compounds, the poisonous influence on field soils ceases, still remains to be determined. The hydrogen-ions are not invariably neutralised. It was noticed that in soils in which there was no calcium carbonate nor magnesium carbonate, the same influence was exercised by the various concentrations of aluminium sulphate or aluminium chloride as in humus sand soils to which 2.5-5 % of calcium carbonate had been added.

In general it may be said that those soils to which calcium carbonate was added removed more aluminium sulphate and aluminium chloride.

I am of opinion that the antagonistic influences of the various cations, which are present in the soil in such large quantities, play a large part in this connection, in consequence of which the toxicity of the aluminium does not attain such a high degree as in water growths, where a large accumulation of cations cannot take place.

It was noticed that with sand leached and heated with hydrochloric acid, the same results were obtained as with water cultures. Aluminium in the form of sulphates, chlorides and nitrates in small quantities had an equally toxic effect. A large part is played by humus matter in the soil which, with aluminium, probably forms humates and has no injurious effect on the root system of plants.

If sterilised, hydrolised and neutralised peat were added to the sand soil, we were able to use up to 0.06 gms. of aluminium in the form of aluminium sulphate or aluminium chloride for barley, wheat, and sugar-beet crops, in the presence of all biogenetic elements, whereby these crops developed normally. In sand without organic matter the early growth of barley, wheat and sugar-beet, in the presence of all biogenetic elements, with a concentration of 0.06 gm. of aluminium in the form of aluminium chloride per kg. of soil, was greatly injured and in many cases the plants died.

We are now firmly convinced that if the soil acidity, expressed in hydrogen-ion concentration, is $P_H = 1.4$, it has an exceptionally injurious effect on plant growth through the presence of SO_3- and SO_4-ions, of industrial waste products, or coal mines, burning cinder heaps, coke-furnaces, etc., or when the hydrogen-ion concentration has arisen from the decomposition of pyrites. In the majority of moist soils, rich in organic matter, the injurious acidity is caused by the natural humic acid. The statement that aluminium compounds in the soil have an injurious effect on plant growth, is based on no exact, experimental foundation.

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A BIO-GEOGRAPHICAL CLASSIFICATION OF THE PRINCIPAL CROPPING SYSTEMS OF THE WORLD.

Plant Sociology has for some years been the object of profound research. Since the fundamental work by Prof. E. WARMING and the publication of the important memoir by F. E. CLEMENTS on the dynamics of plant associations, a considerable number of books have been published on the various plant groups existing on the surface of the globe and their evolution. Botanists have been mostly engaged with the natural associations. They have indeed shown, and A. de CANDOLLE was one of the first to do so, that man has a considerable influence on plant life, which has often been transformed by him, but no naturalist, so far as is known, has examined in detail all the modifications produced. In every country, however, man has substituted for the primitive associations his cultivated crops: the floral composition of pasture and prairie has been transformed, and forests more or less modified. As a matter of fact, four-fifths at least of the land surface of the world is covered with vegetation which has been greatly modified by man and is formed of *artificial associations* or *secondary formations* some of which were produced thousands of years ago and which man maintains in a state of comparative stability, voluntarily or involuntarily, by keeping up the action of the causes which produced them. I have already shown in previous works that the great African forest — the virgin forest of STANLEY — is for the most part only a *secondary forest* formed on the site of ancient growths; it actually forms a long interval of fallowing in the Bantu system of agriculture: the "landes" of the west of Europe, the "savarts" in Champagne, the "garigues" (waste lands) and marshes of the Mediterranean region are also mostly associations re-formed on the site of former growths, or of forests which have been destroyed. Such also is the fallow subjected periodically to the process of weeding, burning and scattering the ashes over the soil, forming the system

of cultivation known in British India under the name of "rab".

Lastly may be mentioned the *terrace cultivation*, practised for several thousands of years on the borders of the Mediterranean, in China, in the Malay Archipelago and by the Indians of South America. Gigantic operations have been necessary to transform whole mountains into the form of an amphitheatre, and these areas rising in stages, which are to-day in many countries covered with brushwood and uncultivated savannahs, were formerly exploited for the production of abundant crops; the terrace arrangement was undoubtedly the only system ensuring a good yield by the soil, and was practised by peoples living far from one another and doubtless ignorant of one another's existence.

When we speak of agriculture, we often think of methods of cultivation which have been practised in Europe, or in countries inhabited by Europeans for some centuries. We lose sight of the fact that in numerous regions of the globe there exist systems totally different from ours, but which no doubt also have their reason for existing. In Europe itself the systems have been modified in the course of centuries and will no doubt be still further modified in the future. In this preliminary work we have tried to show how the different methods of cultivation are linked together.

The systems of cultivation and of the associations which result therefrom, form an important branch of applied ecology. We may call it the practical application of plant associations, since it really concerns plant associations created or modified by man with a view to advantages he wishes to derive from them. Among the plant associations belonging to this class, some are created voluntarily by man, while others are formed involuntarily through his agency; the latter include the rough and overgrown groups, fallow lands, open pasture lands, secondary forests, etc.

In this description, which is believed to be the first comprehensive attempt at grouping cultivation associations, we review the systems of cultivation and the associations arising therefrom, especially utilising the observations made in the course of travels in Africa, Asia, the Malay Archipelago and various parts of Europe. Use has also been made of the publications by V. Mosseri on agriculture in Egypt, those by E. Buck on the *rab* in India, Vanderyst on Bantu agriculture on the Congo, Perrier de la Bathie on plant associations in Madagascar, etc.

Generally speaking, all the systems of cultivation practised

in various countries are adapted not only to topographical and climatic conditions and the state of pre-existent, spontaneous vegetation, but also to social and economic conditions and the state of civilisation of the peoples who practise this cultivation. It is clear that in countries where the population has progressed but little, is sparsely scattered and has at its disposal unlimited areas for cultivation, or in those in which the products from hunting and fishing are abundant, man has improved his agriculture less than in those in which the population is very dense and has already attained a high degree of civilisation. This nevertheless does not always imply that he has had less influence on the spontaneous vegetation, as is shown in the following.

FIRST SERIES. — PRINCIPAL SYSTEMS OF CULTIVATION COMING UNDER THE DOMAIN OF AGRICULTURE PROPERLY SO CALLED.

I. — ABSENCE OF CULTIVATION AND STOCK RAISING.

Man lives exclusively on what he gathers, either by hunting or fishing. Generally (except in regions where he may burn the herbage) he does not deteriorate the primitive vegetation. This system is practised by the Negrillos of the Equatorial African forest, by the Esquimos of the Polar tundra and by the Fuegians of South America.

II. — SYSTEMS OF EXTENSIVE CULTIVATION.

(*A*) **Systems of incomplete cultivation or stock raising,** often combined with fruit gathering and sometimes with hunting and fishing. The primitive vegetation is to a great extent preserved but is modified over large areas.

(*a*) **Stock-raising without agriculture.** Subjected to the movement of the seasons in order to ensure a continual water supply for the herds and pasture in which vegetation has remained apparently more or less primitive, but in which nevertheless the domestic animals have been instrumental in disseminating certain plants and eliminating others.

(1) Reindeer-breeding in the Arctic regions: the composition of the tundra is scarcely modified.

(2) Camel and dromedary breeding in the desert: flora

but little modified, but all woody plants, if constantly browsed, take on an altered aspect and fructify little.

(3) Breeding of cattle or sheep in the mountainous or semi-arid regions of temperate countries: the primitive vegetation is greatly modified, cattle-grazing prevents the re-formation of forest: pastoral populations (for instance, in the Alps, Pyrenees, Corsica, etc.).

(4) Cattle breeding in warm sub-temperate countries and in tropical regions: the forest is replaced by savannahs and semi-natural prairies, generally burnt in the dry season, and the primitive steppe is replaced by modified steppes or pasture; the nomad tribes of the Soudan, Arab tribes of Baguirmi, and Masai of the Belgian Congo (*primitive pastoral system*).

(b) **Sedentary or semi-nomad agricultural life. Agriculture without large livestock.** No ploughing, or only in exceptional cases (par. 7 & 8): the hoe is the principal agricultural implement.

(5) Cultivation in dense tropical forest: felling of the primitive forest and fallowing at long intervals, leading to the formation of the secondary forest, sometimes of palm plantations and occasionally (in Asia) of bamboo forests; *Bantu system in Equatorial Africa* (in Lower Congo, "Vooka" is the name given to the place in the forest which is cropped every 10, 15 or 20 years and where the village is periodically established); "*des rays*" *system* practised by the Moïs in Indo-China.

(6) Utilisation of park-forest or savannah in tropical regions: Partial felling of the forest, sparing useful trees; fallowing for relatively long periods (generally 6 to 12 years) with frequent firing of grass; after being left for some years the soil is again cropped: *System of agriculture in countries without cattle in the African Guinea zone* (various Soudan peoples in the Middle and Upper Niger, Bandas and Mandjias in the Ubangui, etc.).

(7) Cropping in countries which are flooded naturally in the rainy season, the cultivation being carried on during the period of inundation: Planting takes place each year on the same soil, sometimes worked into high ridges, except in the case of rice, the lower part of which is submerged. Sorghum is sown on the top of the ridges standing out of the water, which occupies the bottom of the furrows for at least a part of the time during the growth of the plants; aquatic or semi-aquatic weeds may

be grown between the ridges. After the harvest and when the waters have subsided, herbaceous growth on fallow : *system of rice plantations in a state of protocultivation*, in certain regions of Asia. *Cultivation of sorghum on high ridges* among the Saras and Baguirmiens of the South, in Middle-Chari.

(8) CROPPING OF NATURALLY INUNDATING SOILS AFTER THE WATERS HAVE RETIRED. Sowing is generally done while the soil is still in the mud state. The soil previously occupied by waterside plants has been finally cleared. The crop occupies the soil from 3 to 5 months, profiting from the moisture which remains in the ground. During the same period a large quantity of weeds and annual waterside plants grow up, the seeds of which have remained in the soil from former years or have been carried thither by the flood. After the harvest the soil generally becomes hard, dry and cracked and the weeds dry after having matured their seed. In Egypt the name of *charaqi* is given to this period of fallow ; afterwards the soil is again covered for a longer or shorter period until the next crop. System of cultivation on the borders of the Nile in ancient Egypt and until the beginning of the 10th century (the *Baali* cultivation). Cultivation on the banks of the Senegal, Niger, etc. *Chamcars* on the banks of the Mékong in Cambodia.

(9) DRY-FARMING on the semi-arid steppes. Sowing broadcast on deeply ploughed soil ; cultivation of soil surface after each rainfall. After the harvest the soil is left fallow for one or two years (bare fallow). *Barbary agriculture* in North Africa, Indian of the arid regions of America.

(10) TERRACE CULTIVATION in mountainous regions. To reduce the effect of erosion and retain the greatest quantity of water in or on the soil, the arable land is arranged in horizontal terraces one above the other in the form of an amphitheatre. The primitive vegetation is completely eliminated and only weeds or semi-cultivated varieties remain. Fallowing for one year, every other year, or no fallowing, according to soil fertility. *System of terrace cultivations* practised in China, the Malay Archipelago, around the Mediterranean, in the Canaries, by the Indians of the Cordilleras and Andes, etc.

(*B*) **Agriculture and cattle rearing, but not, or very little, in association.** No ploughing, or only with a primitive implement,

burning and scattering the ashes over the soil and incinerating the animal manure when the latter is used.

(11) Cultivation on the site of the primitive or secondary forest. Fallowing for a longer or shorter period, the land serving as pasture. Brush or forest firing frequent. Formation of pastures of quick-growing associations of grasses (*Imperata cylindrica* is often the dominant grass in tropical countries, and in Champagne *Poa compressa*, etc.) and annual grasses, the seeds being often brought by the cattle or preserved in the soil. After some years of varied crop cultivation the soil is again left for a period of 5 to 10 years to the tropical bush, secondary forest or grass fallow according to the region. System of cultivation by the Mans of Tonkin and by different tribes of West Africa. System followed in various regions of Europe until the 15th century. The present system of burning and scattering the ashes in the "landes" of certain parts of Brittany.

(12) Cultivation in park-forests and tropical savannahs. Grass leys sometimes several years in succession, alternating with fallow (copse-pasture or Savoka of Madagascar). Manured sometimes with burnt animal manure after the last harvest; when the soil is exhausted the land is abandoned, and at first only weeds grow on it, or semi-cultivated ruderal species, which disappear after the second year. Then appears a growth of jungle and young copse, which again forms, after some years, a secondary clearing-forest with certain species of dominant shrubs. After a further period of some years it is again cut and burnt, the useful trees being generally, however, spared at any rate in West Africa. *Known as the system of Savoka cultivation in Madagascar.* Cultivation by sedentary Peuhls at Fouta-Djalon and by the Bambaras in the French Soudan.

(*C*) **System of complete cultivation and livestock rearing.** Peasant farming: use of the plough; cattle and arable farming; utilisation of animal manure.

(13) The system includes fields and fallowing, and land burning; animal manure is spread over the soil after having been burnt. After one or several croppings, the soil is left fallow and then serves as pasture. At this point scarcely anything but weeds grow, all woody vegetation having been exterminated. Hence when again (after 2 or 3 years) burning and ash-spreading is carried

out, branches and twigs must be brought from the neighbouring hedges or forests and burnt at the same time as the grass tufts and manure. The cinders and burning of the soil (which cause the death of certain injurious micro-organisms) fertilise the ground. *Rab system* in West India and at *Ladang* in the Malays.

(14) THIS SYSTEM COMPRISES PERMANENT FIELDS WHICH ARE NOT BURNT, but in which fresh animal manure is ploughed in during tilling; sometimes also burnt lime, marl, etc. are incorporated into the soil. Save in exceptional cases the land is no longer left fallow after 2 or 3 harvests according to certain associations. Spontaneous vegetation has been completely exterminated and replaced by weeds or semi-cultivated species which live in the midst of the cultivated plants and re-sow themselves annually unless the crops are weeded. In addition to the fields there are generally permanent grasslands, which serve for pasturing cattle. *Peasant cultivation of temperate countries.*

(15) EXPLOITATION IS EXCLUSIVELY CONFINED TO IRRIGATED CROPS; the most usual are the rice plantations of the Far East. The soil is ploughed with the aid of buffaloes while it is still wet; it is manured with fresh animal manure; the rice is sown on the spot or transplanted and numerous half-spontaneous aquatic weeds (Cyperaceae, etc.) grow up with the rice. Immediately after the harvest, or even a little before, the soil is dried, cracks, and remains bare or is covered in places with small annual plants of quick growth which have time to seed before the renewal of artificial inundation. Rice is cultivated every year regularly on the same soil, which yields one crop (in Cochin-China) or even two (in Tonkin). System of *irrigating by inundation*: native rice plantations irrigated by the deltas of the Mekong, Red River, Burmah, South China, etc. Elsewhere the crops grown are only flooded between the rows at certain times: irrigated cultivation of cotton, sugar-cane, etc.

III. — SYSTEMS OF INTENSIVE CULTIVATION.

The soil is cultivated almost continuously and the stubble ploughed up shortly after the harvest in the case of annual crops. Weeds are almost entirely eliminated. The soil is kept fertile by suitable dressings of manure produced by livestock, or by chemical fertilisers or green manures (leguminous crops ploughed in green). It is irrigated or watered in countries where this is necessary. The

crops grown are generally selected varieties and some are treated periodically with insecticides or fungicides.

(16) HERBACEOUS CROPS IN ROTATION: cereals, leguminous or green crops in temperate countries: sugar-cane and rice or maize and then leguminous crops in tropical countries: sometimes also, as in the south of the United States, a woody annual, cotton, alternates in rotation with cereals and leguminous plants. *High yield system of agriculture* (for instance in France in the Nord Department and in the Beauce, in the United States, China, etc.).

(17) WOODY PLANTS OCCUPYING THE SOIL FOR MANY YEARS (tea, coffee, cocoa and rubber in tropical countries, vines and orchards in temperate countries). The soil is sometimes bare and without weeds, but ploughed, and sometimes surface cultivated between the bushes periodically; sometimes also the grass is allowed to grow and periodically ploughed in. Some of these crops require the shade of trees, and often last for a long period. In certain rich soils of South America, a coffee plantation may last more than 50 years on the same soil.

(18) MIXED CROPS OF WOODY QUICK-GROWING PLANTS AND ANNUALS. When the plantation of trees or palms is not too dense the spaces between are utilised for growing shrubs or herbaceous plants. Cultivation system of Lower Normandy where the fields of cereals are generally planted with apple-trees. *Oasis system*, where various crops prosper under date-palms. Tea plantations in Ceylon shaded by rubber trees.

(19) INTENSIVE CULTIVATION WITH IRRIGATION. This system is similar to that mentioned in paragraph 15, but improved (intensive manuring, cultivation of selected varieties). Rice cultivation in Spain and Italy. *Irrigated high-yield crops* of sugar-cane in Java and of cotton and cereals in Egypt and Arizona. Even under this intensive system, according to MOSSERI, the *charagi* fallow should be maintained as long as possible in order to increase soil fertility.

IV. — ARTIFICIAL SYSTEMS OF CULTIVATION.

The soil is generally brought to its modified composition by constantly renewed manurings. In such conditions the plants often show an abnormal increase in growth.

(20) GARDEN CROPS in the neighbourhood of towns. CHINA-ANNAM HORTICULTURE, human excrement being utilised.

The following may also be cited as examples of artificial cultivation: hothouse, hotbed, forcing-ground, mushroom-beds in old quarries.

SECOND SERIES. — SYSTEM OF GROWING CROPS AS FEED FOR LIVESTOCK.

Though in the preceding series we have treated this subject in connection with agriculture properly so-called, we will again examine by what means the wild flora may be modified so as to serve as stock feed.

In pastoral or semi-pastoral countries, man has from the earliest times transformed the aspect of plant life by the special cultivation (pasture and grassland) of what serves as a feed for his herds. Nevertheless he has not always needed to eliminate completely wild plants as was necessary in the case of agricultural crops properly so-called. In every country, the stock must generally be content with the uncultivated plants of the country. The uncultivable tracts are reserved as permanent pasture. Often the sites of devasted forests, marshes and fallow-ground are left to the livestock. The primitive plant-life associations are gradually modified by the stock and also by the frequent intervention of man. The associations serving as pasture may be divided into the four following groups:

I. — GRASSLAND.

This name is given to the prairies, steppes and marshes which have partially retained their primitive vegetation. The trampling and grazing of cattle, however, have resulted in eliminating certain species and spreading others. Man also intervenes by extirpating or burning shrubs and plants not utilisable as feeds. In tropical countries brush fires are generally resorted to for the formation of pasture and often result in eliminating a large number of species, and so the flora of these pastures is very poor. In temperate countries man has left for grassland soils which are too poor for cultivation or too moist for growing cereals. These pastures often occupy the site of former forests. Cattle-grazing and the frequent intervention of man prevent their re-forming. Erosion also has often led to the formation of vegetable mould and a xerophytic type of plant is the only one possible for long periods on these greatly

impoverished soils (mountain pasture, Champagne "savarts", short grasses on denuded rocks,etc.). Finally, many pastures were formerly cultivated soils which have been left fallow for a longer or shorter period.

II. — HAY MEADOWS.

A name given to pastures generally well kept and intended for hay, where mostly only forage plants belonging to the wild flora remain ; some foreign varieties have also been sown occasionally. In the temperate countries of the Northern hemisphere, they are only grazed after mowing and sometimes in Spring ; the grass is afterwards allowed to come up, flower, and is cut on reaching full growth, while certain kinds have already shed their seed. They are often cultivated to some extent (through drainage or irrigation, manuring, sometimes sowing with certain leguminous plants and grasses) so that the primitive vegetation is often greatly modified, though the permanent grass covering allows many useless or injurious species to subsist. In countries with high cultivation, these meadows generally occupy the valleys.

III. — GRAZING-LAND.

This name should be reserved for unmown meadows for intensive breeding (J. du Plessis de Grenedan). Cattle are kept almost the whole year on this land which is fertilised by their manure. The soil, constantly manured and enriched by fertiliser when it is not sufficiently calcareous, is covered by wild plants or by the artificial sowing of various species of grasses and leguminous plants which the cattle constantly crop, preventing them from flowering and seeding ; the bare spaces also, as soon as they occur, are covered by the growth of the plants ; development of tufts and growth of rhizomes or runners. Certain plants not eaten by the cattle, on the contrary, form tufts here and there and seed ; they would end by predominating if not removed periodically by man. The soil, for grass-bearing, should be deep, compact and moist, and the climate should be rainy a great part of the year. In Europe the quarternary alluviums, clays and lias marls up to the Cretaceous formation are especially suited to this growth, which requires the frequent intervention of man. In certain countries grass is planted with fruit-trees. A mixed growth of *grazing orchards* is then formed as for instance the grass-orchards of cider-apples in Lower Normandy.

IV. — TEMPORARY GRASS CROPS.

The fields of lucerne, clover and sanfoin, in fact all the forage leguminous plants and sometimes also the grasses (cereals cut green, rye-grass in Europe, and Para and Guinea grasses in tropical countries) come under this group. They are actually crops in rotation with cereals, only occupying the soil temporarily, and therefore come within the domain of agriculture properly so-called. Temporary grass crops only came into practical agriculture in Europe within the last 100 or 150 years, and hardly yet exist in tropical countries.

THIRD SERIES. — SYSTEM OF FOREST CULTIVATION.

The forest associations exploited (*sylvicultural associations*) are less modified than the associations of grasslands preserved by man for livestock. At first these associations seem natural; generally speaking all the species which combine to form them are wild; they are exploited however so as to preserve or cause to predominate the most profitable species. Here indeed it is a question of real cultivation. Species of underwood, almost all useless, have not been eliminated and the majority have adapted themselves to the new conditions. In certain countries however real artificial forests have been formed, especially within the last century or two, and have replaced both natural forests and other associations (maritime pine plantations in the S. W. of France, regrowths of *Pinus sylvestris* in the centre and west of France; forests of teak and Peruvian bark in Java, etc.). These forests, created entirely by man, cannot be distinguished from the natural, preserved forests: the surrounding vegetation has become accustomed to living among the underwood. In their mode of development also they do not differ from the other forests exploited by man. All the intermediate forms between a primitive forest and a forest preserved by sylviculture as subjected in one way or another to intensive cultivation, are met with here. Forest preservation is, by the way, comparatively recent. In France, where systems of forest exploitation seem to date back earlier than in most other countries, COLBERT's statute regulating felling and staddling with due regard to the nature and longevity of each species, was framed in 1669. In most tropical countries forest preservation does not yet exist or is only rudimentary, with the exception however of

the remarkable forest preserves in India, Burmah, Siam, Cochin-China, Java and the Philippines, which, though mainly established less than 50 years ago, already look like the best preserved forests of Europe, and are scientifically treated. The forests of tropical Africa on the contrary are steadily degenerating, all useful species being taken or destroyed, in order to plant non-permanent food crops in their place.

The following is a brief description of the principal systems of forest regeneration and exploitation :

I. — FORESTS NEITHER KEPT UP NOR DEGENERATED.

These have been subjected for centuries to the exclusive influence of natural factors : *Primitive forest*. Such forests exist in very sparsely populated countries. Generally, even in temperate regions, the species are very mixed.

II. — FORESTS PARTIALLY DAMAGED BY MAN.

These re-form slowly into natural forests, either through the agency of climatic factors or through the intervention of man (sowing or plantations), passing through the successive stages of brushwood and secondary forest.

A large number of forests have been thus formed ; they are generally not very homogeneous ; the less damaged places have retained a dense growth, the others are only covered with sparse copses, patches of moorland, etc. They have not yet been completely preserved by man ; such forests are also often in a poor condition owing to fires, voluntarily or otherwise caused, and to excessive felling, grazing, and treating with a view to encouraging the breeding of game for shooting or hunting, etc.

III. — FORESTS RE-FORMED AFTER HAVING BEEN COMPLETELY DESTROYED FOR GROWING CROPS.

After the soil has been exhausted it is abandoned and the forest gradually re-forms into natural forest, passing through the following stages in temperate countries : 1. grassland ; 2. moorland, scrub or waste land ; 3. thickets and brush ; 4. *secondary forest* ; 5. secondary forest of primitive aspect (*final climatic association*). These forests consist of very mixed species, badly preserved and not very profitable. In equatorial regions regeneration is quicker and the passage is abrupt from bare land to more and more complex secondary forest.

IV. — SEMI-NATURAL OR COMPLETELY ARTIFICIAL FORESTS PRESERVED AND UNDER MANAGEMENT.

These forests are of numerous kinds, with very varied forms of cultivated associations, of which the chief are:

(*a*) **High Forests of pure species.** (*i. e.* the plantations are of one species only). — The broad leaved species are distinguished from the *resinous*. The plantation in which the trees are of the same age and that in which they are of different ages should also be considered. In the first case they are exploited by a single felling; the plantation passes through the stages of thicket, coppice, young saplings, until after 80 to 150 years, according to the species, the stage of maturity is reached. In the second case it is exploited by successive fellings. Apart from felling, such plantations require special treatment (felling for clearings, replanting or sowing in bare places, etc.).

(*b*) **Mixed Forests.** — The trees may be grouped according to their characteristic into three categories: *shade species* alone; *shade* with *non-shade* species; *non-shade* alone. The trees however are generally unequal and form mixed groups or clumps. Thus the willow and beech are often associated in the middle region of the Alps. The methods of exploitation and upkeep are the same as for the plantations of the preceding category. Human intervention is often necessary to maintain the equilibrium, certain species having a tendency to encroach.

(*c*) **Underwood under Standard,** is a more or less artificial growth composed of two elements: (1) a lower stage exploited at regular intervals such as *ordinary coppice*; (2) a higher stage of irregularly scattered trees, of varying age, the youngest being *saplings*; the trees are treated by *successive fellings*; the rejuvenation of the coppice is ensured by making clearings. In tropical countries the plantation passes through 2 or even 3 stages.

(*d*) **Ordinary Bush.** — These are growths which can spring up again after each felling through the growth of shoots from the stumps and of suckers which are put forth when the trees have been levelled to the soil. The leaf species alone possess this property in varying degrees. The shoots spring from the felled stumps

after the beginning of Spring and grow, forming clusters, then vigorous clumps, leaving clear spaces between one another. No tree predominates in the ordinary coppice. The latter is exploited sometimes at close intervals of time (12 or 15 years), sometimes at longer intervals (25 or 30 years) when the shoots have attained *pole* dimensions.

The ordinary coppices and those under plantations may be formed of pure species, but more often of very mixed varieties.

V. — ARTIFICIAL FORESTS FORMED OF NON-INDIGENOUS SPECIES.

In many countries man has created new forests or has restored the devastated forests by sowings or planting species originally foreign to the region which have become naturalised therein, their seeds being generally able to resow themselves naturally. The marine-pine forests in the Landes, and the increasingly important growths of *Pinus sylvestris* and other conifers in the centre and west of France, have thus originated. In both cases these are native species from neighbouring regions; but species coming from very distant countries (American oaks acclimatised in France, Australian eucalyptus planted on the Roman plain and in Algeria, etc.) may also, if the climate suits them, become naturalised and finally form new forests, very far from their native country. Various French forests already show numerous species of exotic trees, more or less disseminated among the native growths.

FOURTH SERIES. — SYSTEM OF CULTIVATION IN AQUATIC SURROUNDINGS.

Rice plantations which remain inundated almost permanently and the plants of which are immersed in the water to a certain depth from the beginning of the growth period until earing, constitute a real aquatic crop. The floating rice cultivated in certain lakes in Cambodia, can live over a depth of 2 to 5 metres of water; the plant rises with the flood, but the daily rise of the water should not be more than 10 to 12 cm. for the rice to keep pace with it. China specialises in numerous aquatic crops: *Nelumbium*, *Trapa* or water chestnuts, *Ipomaea aquatica* and various other potherbs grow in the water. The pools where these plants are grown are manured.

Finally, for some years in Germany there has been an increase in the yield in the fishponds through artificial fertilising. H. FISCHER has noticed that superphosphate placed in ponds causes the rapid increase of certain nitrogen-fixing water bacteria: *Bacillus asterosporus*, *Bacterium aerobacter*, *B. radiobacter*, etc. They take up the nitrogen of the air and transform it into albuminoids; reed compost also enriches the water with nutritive bacteria and phytoplankton, on which fish feed. Here again it is a question of a real aquatic growth crop.

***

This brief sketch illustrates the vastness of the field of the application of plant associations. It is a domain which has so far been little explored. It is worth while studying all agricultural methods, even the most primitive. They are almost all the result of long experience on the part of the races that adopt them. Modern science has explained practices which only a few years ago still seemed erroneous. In Europe, fallowing was justified when fertilisers only existed in very limited quantities, for it enabled the stock of nitrogen in the soil to be renewed. The long annual *charagi* fallowing practised by the ancient Egyptians, during which the soil cracked deeply, probably improved the soil of the banks of the Nile much more than the famous legendary oozes. The *rab* system followed in India, which consists in burning the surface soil and even animal manure, leads to a true partial sterilisation of the soil which favours nitrification, as has been shown by recent research. The Bantu system of agriculture followed by the primitive races of equatorial Africa, which consists in felling and burning the forest in order to replace it by food crops, is probably the only one which enables the black to live in countries where stock raising is not at present possible, where manures are unknown and where a constant struggle against the encroachment of the forest must be maintained. This system required harder work by the peasant black than is generally supposed.

The old systems doubtless are not immutable. Numerous improvements may be made in every one of them but preliminary research and tests on a large scale must be continued for a long time to come before methods of cultivation which are considered backward by the European, are replaced by better methods well adapted

to the climatic and the edaphic and social conditions of each country.

According to the happy expression of Prof. Ch. FLAHAULT, the object of all cultivation is to supply man with those plant products which are best adapted to his surroundings and needs; it should ensure a maximum of production for as long a period as possible, bearing in mind the special conditions of each locality.

It is necessary therefore, adds this author, to apply to the soil the same principle as is adopted in the economical management of a house: everything in its place. In cultivation the place for each thing is fixed by the climate, geographical position, local topography, nature of the soil, wild vegetation and stock of water available, no matter where the plant originated. Finally, the degree of civilisation of the population and its density are also of great importance. In Equatorial Africa where there is scarcely one inhabitant to the square kilometre, and in the delta of the Red River where there are more than 350 over the same area, agricultural systems are naturally different.

And so in improving the native agriculture of countries called backward, Colonial Governments should act with extreme prudence. In particular the error should be avoided of believing that methods of cultivation can be unified everywhere. The technical departments of these Governments should not only determine the *vocation* of each soil, i. e., fix the sites which will be reserved for permanent forest, grassland and agriculture, but should also take into account the method of cultivation best adapted to the climate, soil, and grade of evolution attained by the human inhabitants of that soil. Any attempt at agricultural progress in which this last factor is left out of account, would run the risk of failure, and almost always of delay.

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THE CULTIVATION OF LEGUMINOUS SEED CROPS IN ROUMANIA.

General considerations.

Roumania, from its geographical position in the south of Europe, at the gates of the Balkans, is the connecting link between two climates differing in characteristics, and each having considerable influence on agricultural conditions, systems of cultivation and the whole social-economic life.

In the Wallachian plain the climate of the Ukrainian steppe prevails, and extends over the southern half of Bessarabia till in the basin of the Danube it meets the Mediterranean climate, which, coming from the south-west, exerts its influence over Banat and Oltenia.

The curve of the Carpathians, which runs from west to east and then north, the group of peaks known as the " vestiques " of Transylvania, and the chains of hills in Central Moldavia which continue into the middle of Bessarabia in the forest region, impart characters of an orographical type which, in agreement with those of a natural order, form regions quite different from a climatic and agricultural point of view.

In consequence of this, within the present boundaries of Roumania, nearly all the morphological types of soil are found which have formed on the surface of the globe. The great majority of the typical agricultural areas, however, have soils formed under conditions of average or insufficient moisture, containing a large proportion of clay, considerable quantities of humus and a high percentage of salts nutritive to plants, that is, soils with good chemical qualities, and of which scientific agricultural treatment, by improving the physical properties, may still further considerably increase the productive capacity without the aid of chemical fertilisers.

Few of the typical agricultural areas receive an annual rainfall of more than 600 mm. The majority, those on which the agricultural

production of the country is chiefly dependent, receive 500-300 mm., have an average temperature of 9° C. or over, with sudden changes from winter to summer and autumn to winter, have long dry summers, heavy rains falling over a period of a few days, great losses of water by evaporation, and in consequence are regions of a typically arid or semi-arid nature.

The principal factor in the increase of agricultural production is water, a factor which may be influenced in various ways, for instance, by the improvement of methods of cultivation and agricultural technique.

As a logical consequence of natural conditions and of recent political conditions Roumanian agriculture, with the exception of that of certain parts of Transylvania and Bucovina, is chiefly of a cereal character. According to the statistical data of the Ministry of Agriculture for the year 1922-23, over a cultivated area of 10,712,073 ha., representing 36.3 % of the present extent of the country, cereals occupied 9,654,142 ha. or 90 %, while the chief leguminous crops covered only 274,289 ha., or 2.55% of the cultivated area.

On this area, in addition to leguminous crops grown for seed, the chief fodder crops are included, namely clover and lucerne. Deducting these latter, the leguminous crops grown for seed, such as beans, peas, lentils and broad beans, occupy 90,029 ha., or 0.82 % of the cultivated area.

During the years 1919-1923, the areas under the chief leguminous crops varied as shown in Table I:

TABLE I. — *Area under leguminous crops during the years* 1919-1923.

Description of crops	Agricultural years								Average	
	1919-1920		1920-1921		1921-1922		1922-1923		1919-1923	
	ha	%	ha	%	ha	%	ha	%	ha	%
Beans alone	61 783	0.71	81 869	0.82	68 563	0.66	68 065	0.64	70 070	0.71
Beans and Maize (1)	239 485	—	309 912	—	563 208	—	600 944	—	428 387	—
Peas	10 395	0.12	11 941	0.11	11 199	0.11	11 669	0.10	11 076	0.11
Lentils	3 285	0.04	4 592	0.04	12 709	0.12	8 346	0.07	7 233	0.08
Broad Beans. . . .	2 571	0.03	7 812	0.08	1 314	0.02	1 649	0.01	3 411	0.03
Lucerne	28 121	0.33	54 827	0.55	80 491	0.77	85 128	0.80	62 146	0.61
Clover	31 002	0.36	79 423	0,79	93 285	0.92	99 132	0.93	75 710	0.71
Total . . .	137 157	1.59	239 564	2.39	367 561	2.60	274 289	2.55	229 646	2.28

(1) The data relating to areas planted with beans and maize are not included in the totals.

Table I shows that except in the case of broad beans, lentils and beans, the area under the other leguminous crops increased progressively from 1919 to 1924.

The total areas under leguminous crops continually increase between 1919 and 1925, while the percentage of areas also constantly increase, except in the year 1922-1923, when they show a decrease. Finally, the average percentage leguminous crops sown annually again indicates that the cultivation of these crops is insufficient if we consider their importance from the point of view of rotation, agricultural statistics and soil fertilisation, human and livestock consumption, etc.

Except beans, which have long been grown and the pods and seeds of which form one of the principal foods of the rural population, the others have attained agricultural importance only in our own time, and their more extensive cultivation forms one of the agricultural problems of the future.

The extension of the cultivation of peas, which constitute a substantial cattle feed and are in great demand for export, will enable us to improve the defective system of sowing wheat after maize, and at the same time to maintain soil productivity and considerably increase the exportation of wheat.

As regards the cultivation of leguminous crops for fodder, the increase of this system is one of the fundamental conditions for the improvement of our breeds of cattle intended to supply the country's needs, and also for export requirements.

Leguminous crops, according to local characteristics and the degree of intensity and systems of cultivation, occupy areas of varied extent in the different provinces of the Kingdom, as may be seen from Table II (see page 683).

If the totals for the different provinces are examined it is seen that Transylvania holds the first place as regards extent of area under leguminous crops; then follow the Old Kingdom, Bucovina and Bessarabia. As regards the proportion of the total area cultivated, Bucovina takes the first place, followed by Transylvania, the Old Kingdom and Bessarabia.

Leaving out the areas under lucerne and clover, which are not dealt with in this report, as also the areas on which beans are grown with maize, the data shown in Table III are obtained (see page 684).

The figures in Table III show that the four chief crops are variously apportioned in the chief provinces.

TABLE II. — *Areas under leguminous crops in the year 1922-1923.*

Description of crop	Old Kingdom Area ha	Old Kingdom % of total crops	Bessarabia ha	Bessarabia %	Bucovina ha	Bucovina %	Transylvania ha	Transylvania %	Roumania ha	Roumania %
Beans alone. .	49 887	0.92	10 040	0.36	90	0.03	8 040	0.36	68 057	0.06
Beans among maize (1). .	408 725	—	2 069	—	13 640	—	176 510	—	600 944	—
Peas	7 103	0.13	1 424	0.05	519	0.19	2 623	0.11	11 669	0.10
Lentils	2 977	0.05	2 474	0.09	228	0.08	2 667	0.12	8 346	0.07
Broad Beans .	269	—	289	0.01	575	0.22	816	0.04	1 949	0.01
Lucerne . . .	26 474	0.50	1 657	0.06	1 590	0.58	55 407	2.47	85 128	0.80
Clover	3 896	0.07	367	0.01	19 780	7.28	75 089	3.35	99 132	0.93
Total . . .	90 606	1.67	16 251	0.58	22 782	8.38	144 642	6.45	274 281	2.55

(1) The figures for beans grown with maize are not included in the totals.

TABLE III. — *Areas under leguminous crops per province.*

Provinces	Beans ha.	Beans %	Peas ha.	Peas %	Lentils ha.	Lentils %	Broad Beans ha.	Broad Beans %	Total ha.	Total %
Old Kingdom . . .	49 888	0.92	7 103	0.13	2 977	0.05	269	—	60 237	1.10
Bessarabia	10 040	0.36	1 424	0.05	2 474	0.09	289	0.01	14 227	0.51
Bucovina	90	0.03	519	0.19	228	0.08	575	0.22	1 412	0.52
Transylvania	8 047	0.36	2 623	0.11	2 667	0.12	816	0.04	14 153	0.63
Total . . .	68 065	0.64	11 669	0.10	8 346	0.07	1 949	0.01	90 029	0.82

Thus beans occupy a greater relative and absolute area in the Old Kingdom, next come Bessarabia, Transylvania and Bucovina. The Old Kingdom again holds the first place for total area under peas; then follow Transylvania, Bessarabia and Bucovina, the maximum relative area (in proportion to its size) being in Bucovina.

Lentils are grown over larger areas in the Old Kingdom,then come Transylvania and Bessarabia, which has a proportionally larger percentage.

In all four provinces, beans occupy very limited areas; the greatest area under beans is in Transylvania and the largest relative area in Bucovina.

Fig. 110 shows graphically the percentage of areas under leguminous crops as compared with the total area under cultivation in each province.

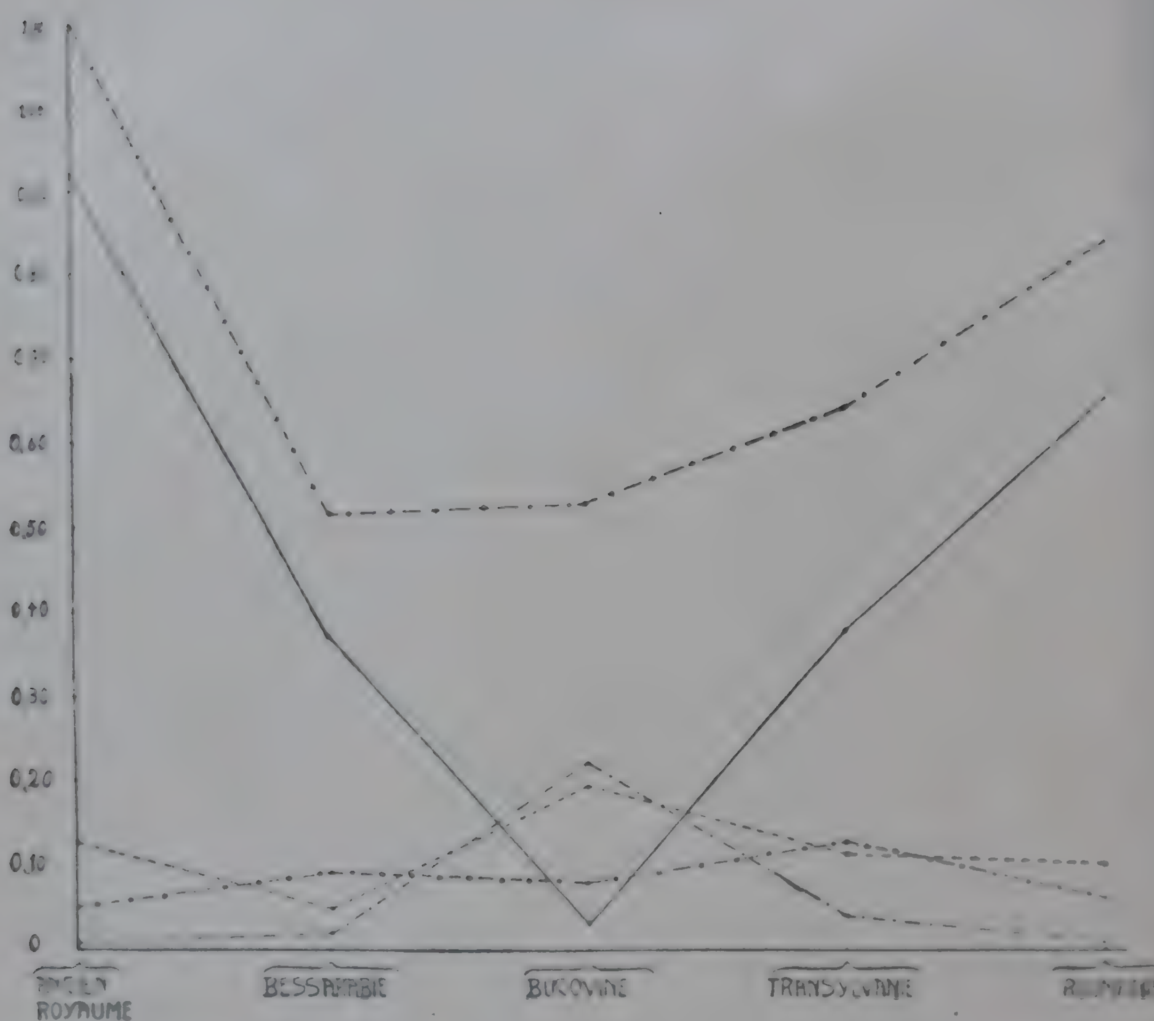


FIG. 110. — Graph showing the percentage of areas occupied by leguminous seed crops out of the total area cultivated in each province.

——— Beans —+—+— Total —o—o— Lentils
——— Peas —.—.— Broad beans

The figures in Table IV show that with the exception of Bucovina the greatest part of the total area in each province under leguminous crops is occupied by beans. Peas take the second place in the Old Kingdom, and lentils in Bessarabia and Transylvania. In Bucovina, owing to its milder and moister climate, broad beans take the first place, then come peas, lentils and beans.

As regards the data for each crop in the four provinces, beans hold the first place in the Old Kingdom, peas and broad beans in Bucovina and lentils in Transylvania.

These facts are better illustrated in Fig. 111.

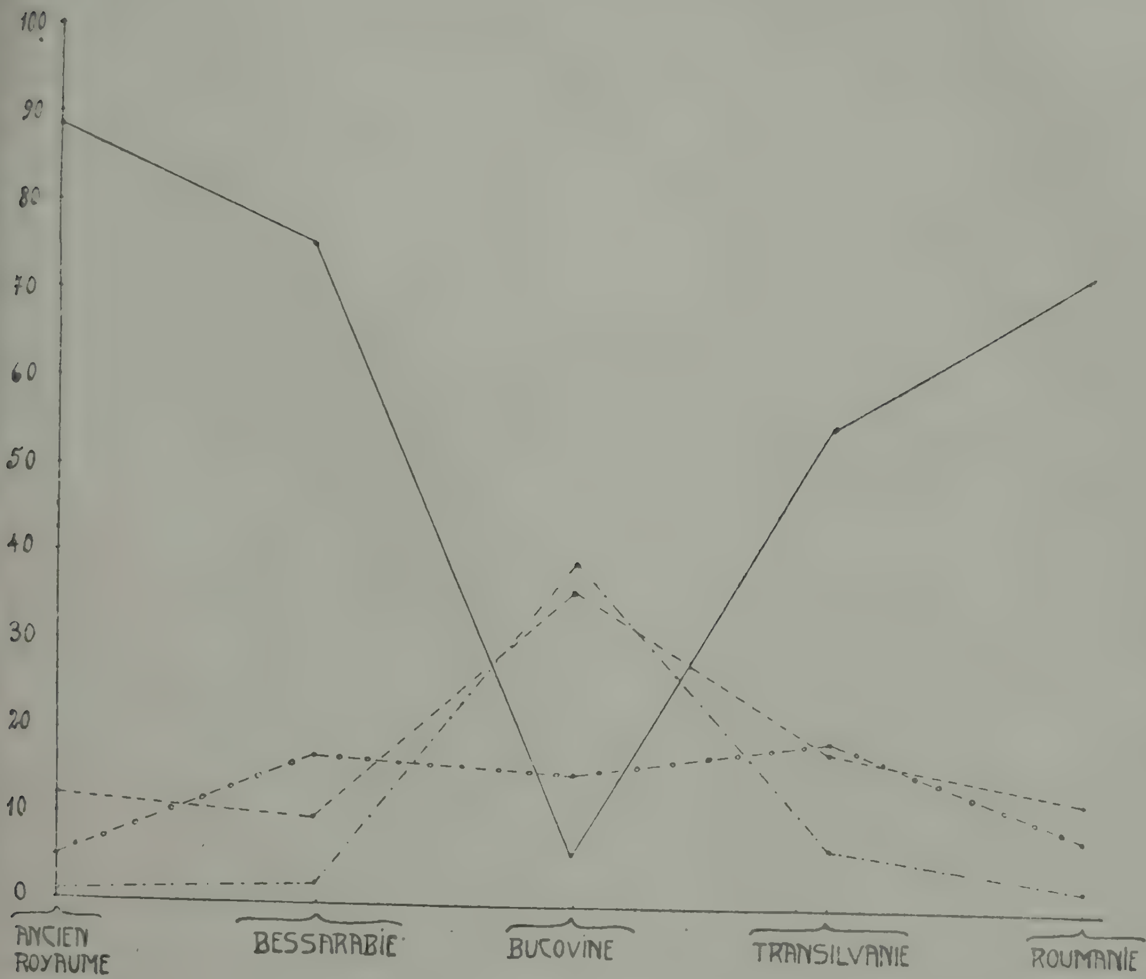


FIG. 111. — Graph showing the percentage of areas occupied by leguminous seeds out of the total area under leguminous crops in each province.

——— Beans
——— Peas
—o— o—Lentils
—.—.— Broad beans

TABLE IV. — *Percentage of areas, under each crop as compared with total area under leguminous seeds.*

Provinces	Percentages of areas under leguminous seeds				
	Beans	Peas	Lentils	Broad Beans	Total
Old Kingdom	82.82	11.79	4.94	0.45	100.00
Bessarabia	70.56	10.01	17.39	2.03	100.00
Bucovina	6.37	36.76	11.15	40.72	100.00
Transylvania	56.85	18.54	18.54	7.77	100.00
Roumania.	75.60	12.96	9.27	5.17	100.00

YIELD OF LEGUMINOUS CROPS.

The absence of conformable systems of cultivation and of a scientific agricultural technique causes the agricultural output of the Country to oscillate from one year to another under the influence of the climatic factors on which the abundance of crop-yields always depends.

In the yield of leguminous crops the same phenomenon is noticed as in that of cereals.

The statistical data for the years 1920-1923 for the whole country (Table V) speak for themselves :

TABLE V. — *Total and average yield of leguminous crops in Roumania.*

Description of crop	1920-1921		1921-1922		1922-1923		1923-1924	
	Total hl	Hl per ha	Total hl	Hl per ha	Total hl	Hl per ha	Total hl	Hl per ha
Beans alone	503 539	6.1	521 231	7.6	835 056	12.3	[illegible]	8.6
Beans among maize	811 690	2.6	1 551 241	2.7	2 171 114	3.7	1 511 352	3.0
Peas	108 217	9.8	166 773	14.8	162 590	13.9	145 860	12.8
Lentils	27 765	6.0	118 146	9.3	96 511	11.6	80 807	8.9
Broad beans	54 688	7.0	19 534	14.8	22 625	11.6	32 282	11.1

The figures in Table V show the great variations in the average production of the four leguminous crops per ha. The average for the three years of the crop yield per ha. also show that the latter is low and much below the productive capacity of the soil and of our climatic conditions.

The variation in yield also depends on the provinces where the plants are grown, and to illustrate this point statistical data are given relating to production per province in 1922-1923 (Table VI) (see page 687).

These data show that during the agricultural year 1922-1923 the greatest yield of beans and peas per ha. was that of the Old Kingdom and Bessarabia, of lentils, that of Bucovina and the Old Kingdom, while Bucovina produces most broad beans. As regards

TABLE VI. — *Yield of leguminous crops in the Roumanian provinces in* 1922-1923.

Crops	Old Kingdom		Bessarabia		Bucovina		Transylvania		Roumania	
	Total hl	Hl per ha	Total hl	Hl per ha	Total hl	Hl per ha	Total hl	Hl per ha	Total hl	Hl per ha
Beans alone	663 055	23.3	100 273	9.9	882	9.8	70 846	8.8	835 056	12.3
Beans among Maize	1 608 946	3.9	19 911	9.6	35 713	2.6	506 544	2.8	2 171 114	3.7
Peas	105 472	14.8	21 207	14.9	5 501	10.6	30 410	11.6	162 590	13.9
Lentils	35 119	15.2	34 090	13.8	3 436	15.1	13 866	5.2	96 511	11.6
Broad beans	3 321	12.4	3 598	12.5	7 517	13.1	8 199	10.1	22 625	11.6

production for export, beans take the first place, then come peas and lentils, and last, in comparatively very small quantities, broad beans.

The general conditions have been described bearing on the importance of leguminous crops in our agriculture : we will now show how each of them is cultivated and the principal varieties most largely grown.

BEANS.

These form, together with maize, the alimentary basis of our rural population, whose food is essentially composed of leguminous plants.

The majority of the population eat only ripe beans (without the pods) made into soup or purée, on all fast-days, which are strictly observed by people of all ages. In spring and at the beginning of summer, this part of the population also consumes the green bean-pods as a salad.

As regards the town population also, beans, either the green pod or the dried bean, form a food of first-class importance. The urban population also shows great preference for preserved beans, which has given rise to a great and very prosperous industry.

In view of the important part played by the bean, especially as a food for the rural population, it is mostly cultivated by the small growers, first for household needs and then for the market.

The large farmers who grow beans for the market or to ensure a well-balanced rotation, do so almost always in co-operation with the peasants, allowing them a proportion agreed upon in advance, owing to the difficulties of cultivation and the work of upkeep which hey necessitate.

Beans are almost always sown after straw cereals, without any special attention being given to the soil. On the small farms, which now comprise, after the agricultural reform, 90 % of the arable soil of the country, the cultivation of beans keeps parallel with that of maize. They are grown either alone, on odd pieces of land, on the borders of maize or potato plots, or among maize, the vine, or other crops. The large farmers grow them in the same way. The greater part of the annual production, 90 %, is sown between maize, as may be seen from the averages for the years 1920-1923. On soils planted with beans, autumn wheat, and sometimes only spring cereals, are sown. Many varieties are grown in Roumania, differing in the form, size and colour of the bean, and these have not yet been studied. The chief of the usual varieties are :

(*a*) *The "common" bean*, white, long, slightly curved, belonging to the *Phaseolus vulgaris* variety, with a climbing or straight stem. it is more frequently grown among maize, which serves as a support, or on sticks ; it is fairly productive. The pod averages 9 cm. long ; the weight of 1000 beans is 330-450 gm. The yield is 900-3000 kg. per ha., and the weight of the hectolitre 72-80 kg.

(*b*) *The "gogoneata" bean*, belonging to the *Phaseolus sphaericus* variety, is a dwarf bean and non-climber ; the colour is white, round, of average size, productive and rather widely grown. There are also climbing varieties.

(*c*) *The "ousvara" bean* (*Phaseolus sphaericus*) also called the "little mountain egg", resembles the preceding variety ; the bean is white, but smaller ; it is mostly grown in Moldavia.

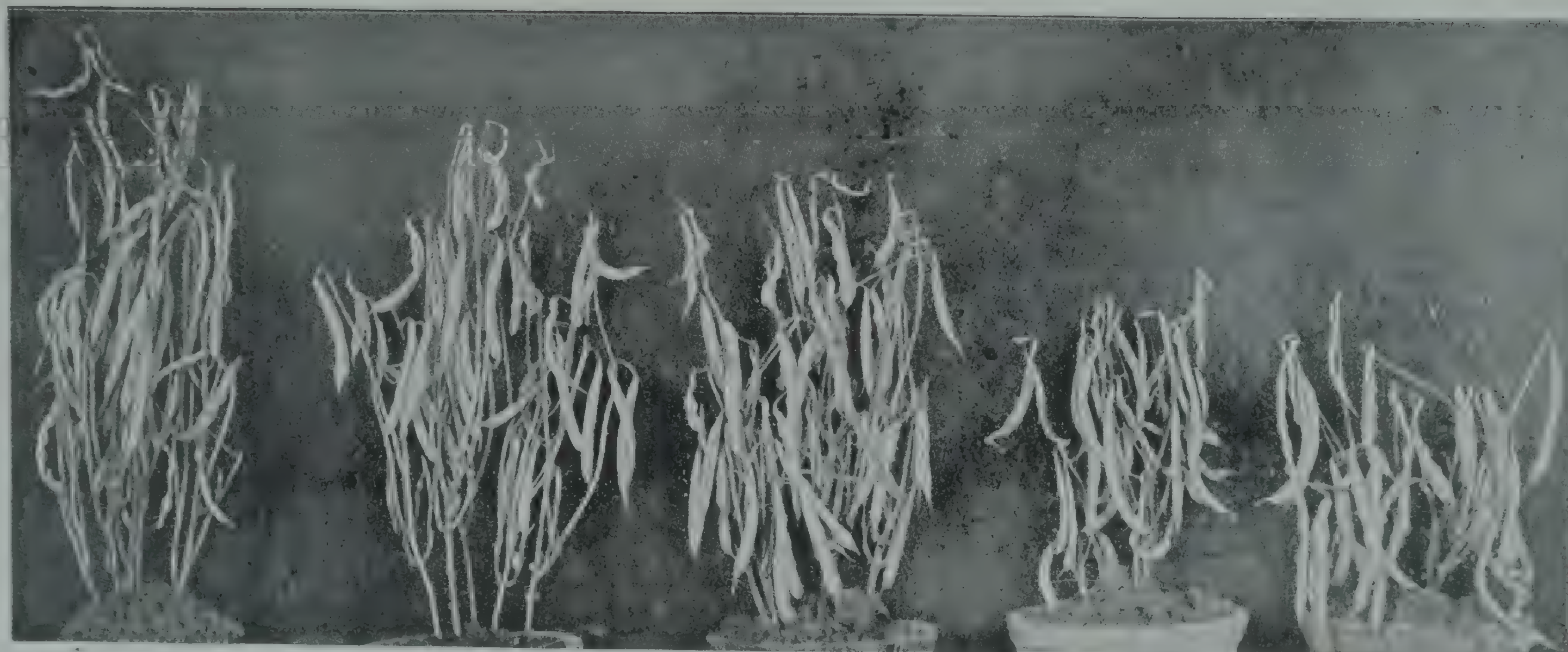
(*d*) *The "copacica" bean* (*Phaseolus sphaericus*) is of average size, round and white. The pod is long and slightly curved towards the end. It is a productive and widely grown variety.

In Plate LIII, No. 3, this variety may be seen with fully matured pods, and in Plate LIV, No. 5, the size and shape of a pod is shown.

(*e*) *The "oloadata" or "latarcata" bean* (*Phaseolus compressus*) is a climber trained, on sticks. It is less common. The bean is long, slightly curved like a kidney and white. The pod has an average length of 9 cm., the weight of 1000 beans is 330-450 gm., and the weight of a hectolitre is 72.8 kg. Plate LIII, No. 2, shows this variety fully matured, with pods. In Plate LIV, No. 1, may be seen the shape and size of the pods and in Plate LVI, No. 11, the shape of the bean.

(*f*) *The "flageolet" bean* (*Phaseolus oblongus*) is a foreign variety, with coloured beans. The chief kinds are : the red, yellow,

PLATE LIII.



1 = Krupbohne; 2 = Obadata; 3 = Copacica; 4 = Alba mica; 5 = Kaiser Wilhelm.

FIG. 112. — Size of some varieties of beans. (After C. ROMAN and J. ENESCU).

PLATE LIV.

Fig. [illegible]. — Some pods of the chief varieties of beans (natural size; after [illegible] and [illegible]).

1 — [illegible]; 2 — [illegible]; 3 — [illegible]; 4 [illegible]; 5 — [illegible]

PLATE LV.

FIG. 114. — Some pods of the chief varieties of beans (natural size, after C. ROMAN and J. ENESCU).

1 = Flageolet vert ; 2 = Zuckerperl ; 3 = Kaiser Wilhelm ; 4 = Schlachtschwert ; 5 = Grosse weisse.

PLATE LVI.

FIG. [illegible]. — Seeds of varieties of beans (natural size, after C. ROMAN and J. [illegible]).

[illegible] = [illegible]; 2 = Kaiser Wilhelm; 3 = Allerfrüheste; 4 = [illegible], gelbe; 5 = [illegible]; [illegible] = Flageolet [illegible]; [illegible] = Flageolet [illegible]; 8 = Non plus ultra; 9 = Mont d'or; 10 = Americana; 11 = [illegible]; [illegible] Schlachtschwert; [illegible] = [illegible]; [illegible] = [illegible]; [illegible] = Flageolet [illegible].

and greenish-white. The last named is most common. The pod is very long and fleshy and can be easily preserved for winter use, In Plate LV, No. 1, is seen the shape of a "flageolet vert" pod. Here. it is well to recall the "tucara zuckerbohne" variety, little grown but highly appreciated for its pods, which may be consumed raw or preserved.

At the Agricultural Station at Bucharest trials have been made for several years with foreign and native varieties of beans.

Table VII shows part of the experimental data collected during 1912 regarding the chief qualities of the varieties grown:

TABLE VII. — *Experimental data concerning the chief qualities of the varieties of beans grown.*

Name of varieties	Length of pod in cm.	Weight of 100 beans in gms.	Weight of a hl. in Kg.	Wield per ha in Kg.	%	Mineral content %	Nitrogenous matter %
1. Copacica	7.4	300	79.8	2 100	13.00	3.72	21.38
2. Obadata.	9.4	330	76.4	1 230	14.00	4.00	20.53
3. Kleine weisse . .	6.6	292	75.2	900	14.00	4.10	23.44
4. Grosse weisse . .	10.12	305	74.0	1 312	12.40	4.20	24.42
5. Schlachtschwert .	11.8	318	73.8	764	13.35	4.20	23.08
6. Kaiser Wilhelm .	11.1	307	73.8	1 062	13.95	3.94	21.26
7. Allerfrüheste . .	9.4	249	76.0	856	12.95	3.97	22.96
8. Flageolet vert . .	8.0	140	75.8	906	16.05	4.00	22.84
9. Nain mange-tout .	7.1	262	76.0	1 062	12.95	4.36	23.81
10. Pariser Eier . . .	6.8	300	79.7	669	15.00	3.52	22.84
11. De Soissons . . .	8.6	299	77.0	1 450	13.15	4.48	21.38
12. Suisse blanc. . .	10.0	385	77.0	1 562	13.10	4.29	22 59
13. Kruppbohne . . .	9.2	331	77.5	794	13.00	3.30	23.62
14. Stammbohne. . .	7.9	316	78.0	1 000	—	—	—
15. Heinrich Riesen .	5.5	255	78.4	344	12.60	4.05	23.57
16. Zuckerperl. . . .	5.3	140	79.0	481	—	—	—
17. Américaine. . . .	7.2	305	78.	1 015	—	—	—
18. Mont d'or	6.9	225	78.8	781	—	—	—
19. Non plus ultra .	8.7	296	76.0	1 069	—	—	—
20. Flageolet rouge .	14.1	262	72.0	1 203	—	—	—

It will be seen that the local varieties "copacica" and "obadata" yield the highest production per ha., the hectolitre weighs heavy, and they are among the foremost as regards percentage of nitrogen. Among the foreign varieties, the most remarkable for production are the "Suisse blanc", "de Soissons", "Grosse weisse", Flageolet rouge" "Non plus ultra" and "Nain mange-tout".

Cultivation of beans. — For sowing, the soil is ploughed deeply in autumn and more superficially in spring. The small growers however only plough the soil once in spring, but with our soils and climatic conditions the crop yield suffers thereby.

Sowing takes place at the end of April or beginning of May, according to the district, the soil then being warm and the late frosts no longer to be feared. If the beans are not sown among other crops, the machine drill is used, which sows them in rows 30-50 cm. apart. By this system 80-100 kg. of seed per ha. is required. In small farming however the beans are sown in hills, forming regular rows. In this case the sower makes holes about 20-30 cm. apart and a boy drops 4-5 seeds in each hole and covers them over with earth. The rows thus formed are 30-50 cm. apart. In this way less seed per ha. is used.

In small farming, beans are always grown among maize. They are sown in a line made before the passage of the plough, which opens the furrow in which the maize is afterwards sown, so that the rows of beans alternate with those of maize. In this way the ridge formed by the plough covers the bean seeds.

The maize is dibbled in lines, in holes, or broadcasted : in each of these cases the beans may be sown in holes.

The upkeep of the fields includes hoeing and ridging up. The first hoeing is done when the plants have a few leaves care being taken to weed well. The second hoeing is done when the plants are near the flowering period. When the beans are sown in hills they are also ridged up at the time of the second hoeing, though this is injurious in arid regions, and is also very costly.

The growth period lasts from 90-120 days, according to districts and varieties. The pods are gathered gradually during growth if they are intended for consumption in a green state, otherwise at full maturity, which they generally reach in August.

When the pods begin to turn yellow and the beans are nearly hard, the plants are pulled up by the roots, placed in heaps and allowed to dry for 4-5 days. The beans are afterwards separated with a flail or threshing-machine ; horses are also used.

Among the most widespread diseases and pests of these plants, among which they do great damage, may be mentioned *Uromyces Phaseoli* and *Melolontha vulgaris*.

PEAS.

Contrary to beans, peas are much less grown as a field crop properly so-called, as is shown by the statistical data at the commencement of this article. The areas under peas belong almost exclusively to large farms where they are included in the crop rotation in order to improve the soil for wheat, or where the peas are intended for the market, or with the stems form a good livestock feed, especially for sheep.

They are not much used as a food by the population except in the towns, where the peas and pods are eaten green or preserved. The town population also consumes the ripe peas, as purée, seasoned with linseed oil. The rural population do not care for these peas, on account of the *Bruchus Pisi* larvae, which attack the peas.

It is noteworthy that during the war entire regiments refused this food, even when prepared with butter or lard or the addition of meat, and only took the daily ration of bread. It was only shortly before the war and in exchange for various benefits, that the agricultural co-operatives through their agronomists succeeded in getting the small peasant farmers to cultivate this plant.

The varieties grow are :

The "Victoria" pea, which is vigorous and very productive, has long straight pods ; the peas themselves are large, round and yellowish white. The growth period is about 3 ½ months ; the plant reaches maturity before wheat.

The "Folger" pea grows less vigorously than the foregoing and its growth period is shorter, it being on this account more esteemed by the growers. The pea is smaller, round and greenish.

Besids these two varieties mention should be made of the sweet pea, different kinds of which are grown in the large kitchen gardens, or on the field properly so-called, for their pods, which are consumed green or preserved.

The greater part of the field pea crop properly so-called is exported.

Pea cultivation. — Peas are generally planted after cereals and before wheat, the nature of the soil not being taken much into account. They are sown in Spring as soon as the snow has melted

and the soil has been warmed a little, generally in March, in soils which have been deeply ploughed the previous Autumn. In sowing the seed is scattered over the ploughed soil, over which an iron-toothed harrow is then passed to cover the seed. By this system 160-200 kg. of seed per ha. are needed. Sowing may also be done in regular lines with a machine drill in well ploughed soil over which the harrow has already been passed. In this case 140-170 kg. of seed per ha. are needed, and a distance of 20-30 cm. is left between the lines. After sowing, the soil is harrowed or rolled according to its condition. No upkeep is necessary.

Harvesting is done in July, when the first pods are mature. The plants are mown or pulled up by the roots, placed in small heaps to dry, then in larger heaps, and when they are quite dry, threshed with a machine or by horse-power.

The cryptogamic diseases which cause most damage are *Uromyces Pisi* and *Peronospora Viciae*. The most prevalent insect pests are *Bruchus Pisi*, *Namestra Pisi*, *Aphis Viciae Plusia gamma*, etc.

Lentils.

Though they do not occupy a very extensive area, lentils are rather largely grown. The areas under lentils, as shown by the statistical data, are owned almost exclusively by the small peasant farmers.

Lentils in the form of soup are consumed both by the rural and urban populations, also as purée, or prepared with meat. They succeed in all soils and all our agricultural districts suit them.

There are two chief varieties, differing in size and colour: (*a*) large, flat and greyish-yellow; (*b*) small, flat and greyish-green or reddish-grey.

Like beans, lentils are grown by the small farmers on small odd strips of soil at the side of those crops which precede wheat. The preparation of the soil is the same as for beans and peas. They are sown in April and May at the same time as beans, by hand, 120-140 kg. per ha. for the small variety and 150-180 kg. for the large.

During growth they are regularly weeded, and at harvest are pulled up, well dried and threshed by horses or with a flail.

Broad beans.

They are much less common than the other legumes. The two chief varieties are grown on very limited areas. The large (*Vicia Faba*

major) has been grown the longer, and only in kitchen gardens, for the pods and beans, which, in a green state, form part of the food of the urban population.

The small variety (*Vicia Faba minor*), though very important as a cattle feed, is grown over small areas by the large farmers and on the Government farms.

The place occupied by the broad bean in crop rotation and the way in which it is cultivated, are the same as for the bean.

Chick peas, lupins, and soya.

Chick peas are also cultivated over small areas, mostly in the warmer regions, such as Bessarabia for instance. The most common variety is of medium size, like peas, round and yellow. The urban population, especially the Greeks and Armenians, eat them dried. Their cultivation is similar to that of beans.

In addition to the plants already enumerated, the *lupin* should also be mentioned. In spite of its importance as a cattle feed, it is grown very little. The best known varieties are: *Lupinus albus*, *L. luteus*, *L. angustifolius* and *L. polyphyllus*.

None of these have become naturalised in cultivation.

Twenty years ago extensive propaganda was carried on in favour of different varieties of *soya* (Chinese pea); all the varieties introduced into Roumania however remained on the experimental field: none succeeded in holding its place or even passing into field cultivation.

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STATE IRRIGATION, AND AGRICULTURE IN THE SOUTH OF ITALY.

Extension of Irrigation in Italy.

The problem of the greater extension of Italian irrigation is now engaging the undivided attention of technical experts and students and is perhaps the most important of the many means by which it is sought to obtain the greatest increase in agricultural production as a means of subsistence for the 40 millions of Italians inhabiting an area of scarcely 300,000 sq. km. and having only limited possibilities of emigration.

One of the most eloquent proofs of this tendency was the meetings held at Milan, the first, on public waters, last October, and the second, on irrigation, in April, on the most important questions regarding technical matters and hydraulic legislation. A further meeting will probably be held at Naples next autumn at which the same subjects will be examined from the point of view of the requirements of the Southern and Insular regions.

As is known, the prosperity of one of the most characteristic forms of Italian agriculture, that of the zone on the left bank of the Po, is due to the irrigation carried on there by methods from which it may be said every country in the world has drawn instruction. Its traditions go back to the dawn of time, and, not to speak of the Etruscans who are said to have been the first who dammed the course of the Po, it is an undoubted fact that at the time of the Romans there were canals and irrigation. Among other historic allusions, is that of the well known line in the Georgics of Virgil:

Claudite jam rivos pueri — sat prata biberunt.

There are also canals in this region of the most remote antiquity, the origin of which has not yet been traced, but which can most probably be referred to the Roman period, when the Padaan Valley had attained a very high degree of economic prosperity.

Here the utilisation of the waters found a most favourable application in a combination of natural sources of supply with the most admirable devices of human art. First there were the ample stretches of perpetual ice and snow in the Alps, which, when they melt, form a valuable supply of water in the summer season, whence the large rivers of those regions enter one of their periods of flood in May or June. The great lakes at the foot of the principal range then act as reservoirs to hold the waters when they are at their highest.

Legislation helped to improve these favourable conditions, facilitating the construction of canals, even those of the smallest capacity, by permitting the occupation of the territories traversed by them, and by means of the well known constitution of the temporary subjection of the waters (*service of coactive acqueducts*) of which there were still traces in the early centuries of the Middle Ages. The Proprietors' Unions then soon sprang up, which by co-operation rendered the benefits of irrigation less costly, while from the XII and XIII centuries the communes and local domains constructed great canals which still arouse the wonder of engineers and to which the Unions themselves could thus connect their smaller tributary waterways. All this activity was still further aided by the constitution of the absolute freedom of possession of landed estates, which was early freed from feudal bonds and regulated by the principles of Roman jurisprudence, whereby for the first time perhaps in the economic history of the world was formed an industrial agriculture with business connections between the capitalist and salaried contractor, as it continues to exist at the present day. This was a great advantage for that region, the soils of which, without the aid of the water, would only give a low yield because most of them are not very fertile owing to the prevalence of silica.

Work on a large scale however in Lombardy and Piedmont came to a standstill for a long period during the foreign dominations after the XV century, and was only resumed on the constitution of the State of Italy. Already in 1859 little Piedmont was begining the construction of the Cavour Canal, when it declared war on Austria, and the new Government also encouraged a number of other works which transformed vast tracts in the subalpine regions. To form an idea of only a part of the activity in this field it will suffice to recall that the Cavour Canal, with the others forming part of the same system, had already in 1908, in the region bounded by the Po and Ticino, 454 km. of principal sectors, 285 of branches and

754 of secondary waterways, besides an infinity of minor networks. The canal has a capacity of about 200 c. metres of water per second and supplies water to perhaps more than 200,000 hectares of soil.

An equally important work was carried out by private means aided by large Government subsidies, provided by special legislation in 1873, modified in 1886 and 1915 and in subsequent years and united in one code in 1923. By it the State undertakes to subsidise irrigation works, including the smallest, down to 1 litre per second, with annuities of 3 % of the cost for the first 10 years and 2 % for a further 10 or 20 years according to the extent of the irrigations, and 1 % for a third decade.

The Italian Government and Irrigation.

A special Department at the Ministry of National Economy supervises the distribution of the subsidies and as far as possible makes enquiries and researches and encourages the work in various ways. A most important part of its work in the past was the compilation of the hydrographic chart of Italy, in which, on a scale of 1 to 100,000, are marked the irrigated and irrigable territories, natural and artificial water courses with their measures of capacity, where ascertained, projects for artificial basins and much other useful information. The chart itself is accompanied by valuable monographs illustrating the hydraulic and irrigation systems of each province, showing the modifications in the system, projects for its extension, and all other matters relating to the water supply. This most important work, in spite of the paucity of means with which it was carried out, might still serve, after slight modifications, or brought up to date and with the aid of a sectional geometric survey, now completed for a great part of the Kingdom, to show the present topographical state of the Italian irrigation system.

The Ministry of Public works is making a series of most useful investigations through a Hydrographic Department whose special duty is to examine the basins of all the water courses. This was already completed before the war for fully a third of the Country and the "Magistrato delle Acque del Veneto", to whom is confided the care of the water supply for the whole of that district, gave effective assistance. Great activity was shown in the formation of rainfall estimation stations, which in the peninsular and insu-

lar zone a few years ago barely numbered 371, while in 1919 they had already risen to 1071.

The legislation on irrigation was afterwards completed by that on public waters, first by the law of 1884 and then by the decrees of 1916 and 1919. The decree of 1919 radically modified the preceding one, for it ratified the principle that all the water supplies from public sources should only be temporary and subject to annual control, even if possessed from time immemorial. Thus concessions are limited to a period of 60-70 years for the larger ones by motor power used for irrigation and of 30 for the other smaller ones, after which period the State might not renew them and might take over wholly or in part the installations and appurtenances according to the circumstance of the case. Many objections however have been raised against this legislation and in the meetings held it was strongly opposed, a resolution being passed in favour of its radical modification.

Irrigation in the South of Italy.

There are many aspects to the problem of irrigation in Italy owing to the great differences between the various localities, and more especially between the great Paduan Valley, the Peninsular part along the Appennines, and the Islands. In the Appennine range there are no high mountains with perpetual snow and ice to ensure a copious supply of water in the summer season, also between its watershed and the sea there are, especially on the Adriatic side and still more so in the Calabrian region and the Islands, very short slopes, sometimes measuring only a few kilometres. Hence the water courses are very numerous, but most of them have limited basins and, especially, a torrential system, whereby they contain abundant supplies of water, sometimes to an injurious extent, in winter, and very little or none at all in the summer, when there is the greatest need of it for irrigation. With the exception of a few canals of small capacity in Tuscany, Umbria and the Campania, in the whole of the remaining territory under examination there are only very small networks, and the subsoil furnishes one of the most frequent sources of water supply.

In this region on the other hand irrigation water is of the greatest advantage, even when the consumption is infinitely less than that in the North. In the Southern provinces indeed 360 cu. me-

tres of water per hectare can suffice for garden and other green crops, and sometimes there are cases of a much smaller consumption, whereas in the Paduan Valley not less than 500 are given. In Sicily and Calabria with a constant supply of 1 litre per second 3-4 hectares of citrus fruits are kept in condition, and about 3 of garden crops, whereas in Lombardy such quantity is barely sufficient for 1 hectare of meadow and 30-30 ares of rice. The fact is that, whereas in the North irrigation water is at most a means for increasing crop production, possible even without irrigation, so that it must be applied with a certain liberality, in the extreme South and in the Islands it renders certain crops possible which otherwise could not live. Moreover there is no crop there which does not derive the greatest benefit from even a modest supply of water, from wheat to the vine itself, especially where it is necessary to make up for the serious lack of summer precipitations, which sometimes endangers the yields of woody crops.

A great part of the Southern and Insular regions indeed during this period has only 50-100 mm. on an average, and not infrequently there are years in which from the beginning of April until November scarcely a drop of rain falls. Where however there are no woody crops, after the grain harvest no others are possible, nor throughout the year are any possible except those sown in Autumn. In such conditions therefore, if small quantities of water are available, say from 2-3000 cu. metres, i. e. scarcely 0.25-0.35 litres per second for a period of 3 months, this is sufficient to return a good yield from so rich a soil, which during the whole of that period would have remained unproductive. And then the hot Southern sun, so trying if accompanied by drought, becomes on account of its intensity so much more effective for production.

For this reason the yield of irrigated soils in the South is, all other conditions being equal, superior to that of the same in the North, for in addition to the action of the water in the warm season there are added the effects of the mild climate of the previous winter. In any case the economic effects of irrigation are most convincingly shown by the recent figures relating to agricultural produce returns.

Last year a general revision of these figures was made, and they were quoted for the whole Kingdom in gold lire, as was the case for the land on 1st January 1914. The returns relating to gardens and citrus crops have shown from their exceptionally high figures

how the yield of the soil benefited from irrigation water. The first for instance, at Milan, reached a possible maximum of 600 lire per hectare for that commune, and in the province and generally throughout Lombardy they are not above 450, whereas in the neighbourhood of Naples garden crops rise to 1000 lire and in the province 800-900 are frequent, while at Palermo they are 950. In the same districts, where the best dry soil does not give returns of above 80-100, irrigated soil easily attained 250, 300 and even 400. The figures for citrus fruits are even more characteristic: those for the best in the provinces of Naples, Caserta, Reggio di Calabria, Catania, Syracusa and others, attained maxima of 1400 and even 1500. Returns of 1000-1300 are frequent, and no first class citrous areas, even in the least favourable conditions, were at less than 800, always of course in gold currency. Only water renders possible such miracles of production in which these high profits are possible.

Irrigation work in the South of Italy.

In the majority of cases the water comes from small springs, mostly drawn up from the subsoil and very rarely from canals with a constant supply in the summer season, for the reasons already given. The pumping up of water is mostly practised in districts far from the coast, and in the past it was almost solely done by animal power on the pulley system, the apparatus being sometimes of very rough construction giving necessarily very limited results. Today however the number of installations worked by mechanical and electric motors is continually on the increase, and in some coastal zones, as for instance in the Province of Lecce and in Sicily, wind-motor installations are also working.

Moreover the methods by which in some provinces water is sought and drawn from the soil are surprising. Of these one of the most characteristic is that of the *filter galleries*, so numerous and continually on the increase in the Province of Messina, and some examples of which are also to be found in that of Palermo. They are works constructed under the beds of the numerous short local torrents to hold up and collect the subterranean waters which flow down into them. The torrents themselves flow through channels which they have worn in formations which are mostly granite and schist, sometimes calcareous, and which have then become filled

with pebbles and gravel, among which the waters disperse to the sea. These deposits are then banked up with subterranean dykes, which do not emerge on the surface, but which hold back the water. Then, at the base of the dyke, is constructed a gallery furnished with pipes which draw off the water, and these, through a canal which connects with the gallery, are conducted to irrigate the land lying below, sometimes also supplying motive power.

An investigation made by Prof. GUIDO INFERRERA (1) in 1907 gave a list of about twenty such works and of 10 others in course of construction, besides several requests for water supply. Some of the first-mentioned dated back to the XVI century, and these generally had a minimum capacity, in some cases even 5-6 litres a second, and very few approached 100: many had galleries at a depth of 20-30 metres below the bed of the stream, some even at greater depths. Thenceforward their number has been increasing considerably.

The above mentioned works cannot therefore supply water except at a very high cost, so that even before the war they gave 1 cu. metre at not less than 18-20 centesimi, and a citrus plantation requiring 2500-3000 cu. metres incurred an expense of as much as 600 lire a year, and now from 5-6 times as much. But at the same time soils of low fertility produced as much as 100-150 quintals of oranges and 150-200 thousand lemons, or a gross profit of 3, 4 and even 5 thousand per hectare in gold currency.

Not less important economic results are obtained from the cultivation of green crops or even the simple cultivation of field crops, from which, even with modest irrigation and suitable fertilisation, seven crops a year of lucerne, with 120, 130 and even 150 quintals of hay, have been obtained. This is the most convincing proof of HEUZE's saying that "*two of sun and two of water do not make four but eight*", and perhaps also sixteen in countries with a warm arid climate, where the agriculturist who carries out improvements can scarcely turn to any but woody crops and to the utilisation of the very small streams of water he succeeds in finding.

(1) GUIDO INFERRERA, *The Sources of Water Supply from under the beds of Streams in the South.* « Le derivazioni subalvee del Mezzogiorno », Catania, Battiato, 1907. Page 18 and foll. The author however declares that he has examined only the chief subalveous sources, leaving aside the smaller ones with which are collected, even with short galleries, streams of water to irrigate a few ares of citrus fruits or garden crops.

The ingenuity shown in the construction of the filter galleries is equalled by that, no less ingenious, of the so-called crown reservoirs in the Province of Piacenza. They consist of reserves formed by surrounding the base of a hill with banks of earth in a half-moon shape (hence their name) to collect the waters which flow from the higher land, or are conducted thither by small streams close by. They are very modest works which rarely have a capacity of more than 100,000 cu. metres, but which supply water at a very low cost and might be extended to many other districts.

Moreover, the construction of large artificial basins has also been one of the problems solved in the last 30 years, and the law of 1919 has encouraged it by setting aside for the purpose subsidies up to 8000 lire annually for 50 years for every million cu. metre collected. Several such works are already in use in various parts of Italy, such as Bragimone (Bologna) and Tirso in Sardinia, and some immense works are in course of construction, among which are the Sila lakes in Calabria and those of Cosenza and the reservoir of Upper Belice in the Province of Palermo. The great heights at which the waters are collected will enable hundreds of thousands of horse-power to be developed for use in agriculture and industry and the waters will then be used for irrigation. Moreover, plans for several others have been completed — the State has been waiting several decades for them — and when the works thus planned have been carried out, tens of thousands of hectares will have their present low yield much increased and fully assured.

But though such works have a brilliant future owing to the double advantage they will confer of motor power and irrigation, we consider that, for the present, preference should be given to the smaller schemes, because of more immediate advantage. When these are in extensive use, the farmers themselves will very probably request the Government to carry out the great projects in order to extend irrigation, the advantages of which will have been appreciated more fully and their application to agriculture will have been well learnt.

In the work now being carried out in the districts of the South the small canals, mostly of a few litres per second, are still in the majority: the unit of cost is much greater than for those of large and medium size in the Paduan Valley, but, on the other hand, the results are greatly superior and the scarcity of supply is sometimes compensated for by the increased number in which they are

found. And it is on account of the great returns they bring that they should be sought after and retained even by costly devices which elsewhere would result in a loss; such devices consist especially in underground investigations at considerable depths for taking advantage of the costly filter galleries already described.

The application of mechanical motors, which raise a cubic metre of water at a cost $^1/_4$ or $^1/_5$ less than by the use of animal power, has enabled very deep springs to be utilised, so that in Sicily for instance, there are installations which draw water from a depth of 30 to 50 metres, for the irrigation of garden crops and citrus fruits. The supply of electric power in the country therefore, may become one of the most effective means of agricultural improvement and increased production, especially where it is available at a very reduced cost through the agency of natural waterfalls, or water retained in artificial reservoirs.

Small irrigations.

All these problems relating to small irrigations, and still more those in the warm arid regions of Italy, were not taken into consideration until very late, by the legislation already referred to. That of 1866 indeed, which granted annual subsidies of 3, 2 and 1 % respectively, during the three decades succeeding the completion of the works, reduced these subsidies to $^2/_3$ of the above figure for supplies of less than 100 litres per second and only in exceptional cases granted them to those of less than 25. The Apennine region and more especially the South and the Islands, thus remained excluded from the benefit of the subsidies, in spite of the more unfavourable conditions existing for irrigation undertakings.

This was made clear only later: the writer was perhaps the first to take the question up in a report to the Congress of Italian Agriculturists at Cagliari in 1905, and spoke in favour of the same principles at the Royal Commission on Irrigation appointed in 1910, after the enquiry as to the conditions of the peasant farmers of the South and of Sicily, which enquiry drew special attention to the necessity of encouraging by every means the increase of agricultural production. In consequence of this, the subsequent laws extended the benefits of the larger subsidies to canals having a capacity of one litre per second, even increasing them for these small

schemes and allowing them to be converted into total grants to be paid in advance, or to serve as a loan guarantee.

Meanwhile, with or without State subsidies, energetic work is being carried on everywhere in the matter of seeking and utilising subterranean and artificial waters. Along the Apulian shore from Gargano to Bari, by means of the former, sterile sand dunes have been converted into gardens, and there also even brackish waters are utilised. Elsewhere, for instance in the small province of Campobasso, in a few territories, 10-12 Irrigation Associations have already been formed, in spite of the prediction that this kind of institution cannot become established in the Southern provinces.

It is still a question however of small schemes, the prevalence of which is also shown in notes for a work by Cav. ORONZO VALENTINI, of the Ministry of National Economy. He points out that in a single year 148 subsidies were granted, of which only one was for the large work of the "Vittoria del Piave" Canal (Treviso) for 33 000 hectares, and the remainder for a total area of 5838, or an average of 36 ha. each. Indeed, whereas in Piedmont, Lombardy and Veneto, there were in all 62 requests for 3994 ha. in addition to the aforesaid large one, i. e. an average of 68 ha., each. in the rest of Italy there were 85 for 1344 ha., or 15.81 ha. each.

The state of the Italian budget did not allow of setting aside more than 3 millions yearly for these subsidies, in which are also included those for substituting mechanical motive power for the installations for pumping up water already existing. Such a sum however is inadequate for the needs of the Country, where to-day is seen the exceptional activity already referred to in seeking and utilising every kind of water resource, and especially subterranean ones, the more so that the subsidies in question would soon be returned to the State in the form of an increased volume of taxes, direct and indirect. Nevertheless, up to 30th June 1923 the State has subsidised irrigation works costing over 41 million lire to the extent of about 40 % of the cost, and the 1923-24 budget granted about 3 millions to projects completed for more than 1000 hectares of soil. Many others for large and small irrigation works are now being examined, for which it may be estimated that in a year or two Italian finances will aid irrigation to the extent of 5 millions yearly for about 30 years. Through the application of the Royal Decree of 11 December 1921, which subsidises investigations for subterranean water for the purpose of irrigation, and for human

and animal drinking purposes, subsidies have been given to the amount of 50000 lire, and finally 25 boring apparatuses have been acquired and handed over to the care of the Travelling Chairs of Agriculture, who grant them for use by those who intend to make borings for subterranean water, and several such have been made, some to a depth of as much as 100-150 metres. The total area of irrigation work now being examined may be estimated at about 100000 hectares, the majority of which are investigations for subterranean water. Moreover the continual efforts being made all over the Country and especially in the Peninsular zones and in the Islands show the great influence of the diffusion of electric motor pumps in extending irrigation and the economic advantages attendant on their use, and how necessary it is to carry on special work in aid of this system (1).

Conclusion.

From what has been said it is evident that the Third Italy has been able in this field also to carry out her task with honour and to develop a programme of activity and work which disposes of the *dolce far niente* legend so unwarrantably and detrimentally attributed to her.

The efforts she is making and has also made in the past to overcome the natural difficulties created in a territory in great part hilly and mountainous, and too often infertile by a climate which is arid over fully half of its extent, show the nature of the energy which still animates the old Italian race and the truth of Vittorio Alfieri's maxim that "to the plant man Italy was always a propitious land."

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(1) I tender my sincere thanks to Cav. Valentini of the Hydrographic Department of the Italian Ministry of National Economy, who has furnished me with some of the data and much of the information contained in the present article.

INTERNATIONAL ASSOCIATIONS

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Papers.

METHODS OF MECHANICAL ANALYSIS OF SOILS.

Some years ago I received from a colleague in X. some soil samples with the results of the mechanical soil analysis. Table I shows the results of the investigations carried out at X., and at Groningen, of three samples of soil with the humus removed.

TABLE I.

Soil Sample No.		1120		1121		1122	
	Fraction	X	Gron.	X	Gron.	X	Gron.
%	I . . .	33.6	61.7	47.8	70.3	2.7	1.3
	II . . .	42.6	22.2	31.4	15.1	9.1	5.8
	III . .	20.3	10.1	17.5	10.3	32.9	12.5
	IV. . .	3.2	0.2	3.8	4.0	55.3	80.4
	$CaCO_3$.		5.8		0.3		0.0

I am convinced that results of the kind shown in this table will be the rule in the case of comparative analyses conducted in different laboratories.

The great differences arise mainly from the methods of preparation followed. It is hence a first essential to come to an agreement on the method of preparation of the soil samples for mechanical analysis.

The principal object of this article is to describe and to justify those methods of preparation which were finally adopted after a

number of analyses conducted in the writer's laboratory jointly by A. Dekker, M. Dekker and H. Osterveld.

The second part of the mechanical analyses of soils, namely the separation of the soil particles after the preparation of the samples, was always effected in the Atterberg decantation cylinders and the samples were separated into the four Atterberg fractions.

In conclusion I propose (under heading B) to add some observations in regard to the new sedimentation methods, as followed by Wiegner, Oden, Robinson, and Krauss.

A) THE ATTERBERG METHOD OF DECANTATION.

At the first meeting of the Committee for the study of Soil Mechanics and Physics in Berlin, on 31 October 1913, I referred to the important influence of the preparation of the soil sample on the results of mechanical analysis. On that occasion I recommended a method by agitation with subsequent decantation, of Fraction I with dilute ammoniacal water, and of Fractions II, III, and IV with water (1). These fractions are the four Atterberg fractions: the decantation is carried out in accordance with Atterberg's directions, in the Atterberg cylinders (2). This type and method of decantation, as also the division of the soil particles according to Atterberg into four fractions (2-20-200-2000 μ), was retained throughout the analyses now to be described.

As long as the soil contains calcium carbonate or humus or both. the employment of the method of agitation is hampered by difficulties of various kinds:

(*a*) the calcium carbonate and the humus are distributed by the agitation over the different fractions, and accordingly, to determine the content of the sample in mineral particles of different sizes. the calcium carbonate and the humus must be determined in each separate fraction and removed. It may be noted here that the determination of the humus by means of ignition of the fraction is misleading, as the Fractions I and II contain in the weathered silicates considerable quantities of hygroscopic moisture.

(*b*) Calcium carbonate and humus cement the mineral particles of the soil, and the aggregates thus formed are not fully separable by agitation so that the dilute ammoniacal water used in decantation of Fraction I cannot dissolve all the organic matter. The presence of these cementing constituents (calcium carbonate

and humus) is also to be detected in the fact that the decantation especially of Fraction I and also of II takes a long time.

(*c*) It is not unlikely that the quantities of calcium carbonate and humus still present exercise an influence on the flocculation of the mineral soil particles. In the case of the decantation by the ATTERBERG method this influence becomes in practice very small: in the processes followed by ODÉN, WIEGNER, KRAUSS and ROBINSON, small quantities of calcium carbonate and organic matter must modify the results not inconsiderably.

I have attempted to obviate these difficulties by substituting for the agitation method the English method (3), viz., treatment with HCl and decantation with NH_4OH. By the English method the soil sample is worked up with HCl. As this operation is laborious and also gives rise to errors of a subjective kind, I have proposed to stir the soil sample with cold HCl and indeed with 100 cc. 0.2 n. HCl excess of what is required for the solution of the calcium carbonate (4).

As early as 1921 I observed that the Fractions II and III in the case of sóils rich in humus continue to retain humus. It proved later that treatment with cold dilute HCl does not even succeed in dissolving all the carbonates in solution, as is shown by the following figures:

TABLE II.

No. of Sample	Total $CaCO_3$	$CaCO_3$ in the fraction			
		I	II	III	IV
B 1459	9.26 %	6.84	2.41	0.01	0.00
Bb 17	12.57 %	10.47	1.68	0.42	0.00
Bb 29	11.12 %	8.50	2.30	0.32	0.00
Bb 74	4.06 %	1.74	2.09	0.23	0.00

The following procedure may be adopted to overcome these difficulties:

The organic matter is removed by boiling with H_2O_2 by the Robinson method (5), *while the carbonates are dissolved by boiling with a small excess of dilute HCl,* (100 *cc.* 0.2 *N. HCl excess*).

At the Rome Conference (May, 1924) some opinion adverse to this preparatory treatment was expressed, both during the official discussion of the subject and also in personal conversation. In

particular the employment of acids, especially of boiling acids, was deprecated. On this account I shall deal with the question of the preparation of the soil samples with boiling HCl in more detail.

Treatment of Soil samples with Hydrochloric Acid.

I submit the following five observations for the consideration of opponents of the HCl treatment.

1. *Comparison of the HCl treatment with the agitation method, in the case of clayey soils free from $CaCO_3$ and humus.* — All scientists, including those who intend to make use of the soil in the least altered form, prepare the samples to some extent before decantation. (The various methods are: crushing and rubbing down with rubber pestle, brush or the finger, with addition of a little water, simmering with water, etc.). In all these methods a fairly considerable subjective error is inherent: the more forcibly the sample is rubbed, and the longer it is stirred or boiled in water, the higher is the content in small particles (Fraction I, resp. Fraction I-II). The method by agitation (1) was in this respect undoubtedly a great step in advance, and various opponents of the HCl treatment have consequently adopted this method of preparation. I desire to call the attention of these objectors to the results of analysis of a sample 1458, which was completely free from $CaCO_3$ and organic matter, the single soil particles thus being cemented together not by calcium carbonate and humus, but only by gels of Al_2O_3-SiO_2-Fe_2O_3.

Table III.

Method of preparation	Percentage content in fraction			
	I	II	III	IV
a) Agitation (1)	53.8	28.2	17.8	0.2
b) modified English method (4)	54.0	28.7	16.9	0.4
c) as (*b*) but boiling with HCl . . .	54.9	28.0	16.8	0.3
d) Boiling with H_2O, decantation with H_2O	27.5	37.9	34.4	0.2

The decantation of Fraction I took place in (*a*) with ammoniacal water immediately after the agitation: in the case of (*b*) and (*c*) also with ammoniacal water, but only after the HCl and the salts that had passed into solution had been removed by decantation with water (6). The differences between (*a*), (*b*), and (*c*) are

very slight. This becomes the more obvious, when methods (*a*), (*b*) and (*c*) are compared with (*d*). And as already remarked the results following on the (*d*) preparation are influenced to a large extent by the length of the boiling.

2. *The 'sandy' character of the sand fractions.* — It is of course a difficult matter to distinguish which of the methods (*a*), (*b*), (*c*) or (*d*) yield the true mechanical composition of the soil sample 1458. The simple fact that method (*c*) gives the highest content in Fraction I is no evidence for its correctness. Perhaps the following considerations may be of use in judging of the different kinds of preparation. Fractions III and IV are called the sand fractions, and it is therefore desirable that after decantation of the Fractions I and II a really sandy mass be left behind. This is the case with methods (*a*), (*b*) and (*c*). When method (*d*) was followed, however, the fractions III and IV, viz. 34.4 + 0.2 = 34.6 per cent., formed after evaporation a fairly compact mass, which might be called 'clayey', but even when rubbed between the fingers had no sandy feel. The separation between 'clayey', and 'sandy' particles was thus not accomplished by the (*d*) method.

The writer has made further experiments to see if the behaviour of the fractions towards different colouring matters may perhaps throw light on the point. Whereas the particles of Fraction III obtained by the methods (*a*), (*b*) and (*c*) only fixed a small quantity of colouring matter (methyl violet), the result was on a much larger scale in the case of the particles obtained by method (*d*). I should like to recommend colleagues to make further experiments in this direction. It must be remembered that it is a question of a kind of adsorptive fixation so that the concentration and the quantity enployed of the methyl violet solution is of importance (7).

3. *Examination of Fresh Soil Samples.* — The following investigation is calculated to remove the prejudice against the HCl treatment. In February 1921, after a very wet winter a recently formed soil (Finsterwolderpolder, Prov. Groningen, dyked 1819) was examined. The soil was quite wet and contained 27 % water (dried at 105° C.). In comparison with other soil samples taken in the neighbourhood the volume weight (the weight of 100 cc. of soil in the natural condition in dry matter) and the specific weight are 1.25 and 2.5 respectively. The pore space is thus nearly 50, and if all pores are filled with water, the water content becomes nearly 28 per cent. Half the sample was examined in the wet state, the other as air-dry fine earth (size of

particles 2 mm.) and the following procedure was adopted in the preparation of the samples:

(*a*) Stir with H_2O in a mortar, allow it to settle, pour off into a litre flask (8), stir the remainder again in the mortar with water and pour off, repeat this several times, and finally rinse the whole soil sample into the litre flask. The litre flask is very slowly rotated in a rotary apparatus for two hours a day for two days, the content is rinsed into an ATTERBERG cylinder and Fraction I is decanted with water only. Fractions II, III and IV are as usual decanted with water. In the different fractions the content in $CaCO_3$ is determined and subtracted. The fractions are dried at 105° C. and not ignited.

(*b*) according to the English method as modified by the writer (4) the sample is agitated with 100 cc. excess cold 0.2 N. HCl and decanted first with water and then with ammonia. Fractions II, III and IV are decanted with water, dried at 105° C. and not ignited.

Finally the air-dried soil sample was treated according to the new method, i. e. boiling with H_2O_2 and 100 cc. excess 0.2 N. HCl and then treated as under (*b*).

It may be noted that only Fractions II, III and IV were weighed: the weight of Fraction I was reckoned from the difference. In the same way the $CaCO_3$ was determined only in the case of fractions II, III and IV, and in the case of I was estimated by difference. The results are shown in dry substance (see Table IV).

Later on it proved (see below) that the calcium carbonate does not pass completely into solution on treatment with cold HCl (method *b*). The figures of Fraction II (possibly also of Fraction III) are accordingly probably too high with method (*b*): the figures relating to Fraction I (44.1 % and 45.5 %) are correspondingly somewhat too low.

TABLE IV.

Soil Sample No. [illegible]	Method	Humus	$CaCO_3$	Content in fractions I	II	III	IV
1 moist	a		8.8	42.2	21.8	16.9	0.2
2 "	b		8.8	44.1	[illegible]	[illegible]	[illegible]
3 airdried fine earth	a		8.8	25.5	36.6	28.6	0.4
4 "	b		8.8	45.5	[illegible]	[illegible]	[illegible]
5 airdried	H_2O_2-HCl (boiling)	2.6	8.8	48.3	25.0	14.8	0.5

It appears from the above that the treatment of the wet soil samples with water only (Method No. 1) yields almost the same results as the treatment with HCl (Methods 2 and 4). Also the differences between the results of (*b*) (Methods 2 and 4) and of the new method (boiling with H_2O_2 and HCl), or method 5, are not great. On the hand the differences are quite considerable between method 3, i. e. (*a*) applied to the air dried sample, and the other four methods. It is unconditionally established that the results of method 3, i. e. rubbing up of the airdried sample with H_2O in a mortar and rotation with water, are incorrect as regards the mechanical composition of this soil On the other hand it is proved that the treatment of the sample with cold HCl (No. 2 and 4, method (*b*)) and similarly with H_2O_2 (the ROBINSON method) and boiling HCl (Method No. 5) gives figures, which in any case do not differ very much from the figures of Method 1, i. e. the treatment and decantation of the wet soil sample with water only.

(4) *Boiling with HCl.* According to the new method, boiling with HCl takes place and by the ROBINSON H_2O_2 method with 100 cc. 0.2 N. HCl excess; thus for example 10 gm. of soil with 7,5 % $CaCO_3$ are boiled with 175 cc. 0.2 n. HCl and 25 cc. H_2O for 15 minutes. The reason for this modification of the method is that the calcium carbonate is not fully dissolved by the cold treatment with dilute HCl. It has been observed that the boiling acid dissolves the clayey substances in not inconsiderable quantities. The writer had previously noted that the cold acid also dissolves the clay (4), and the question arises now whether in this respect there is much difference between the quantity dissolved by the cold acid and that by the boiling acid. Table V gives the results of an examination of certain samples. Naturally in addition to SiO_2, Al_2O_3 + Fe_2O_3 (Total acids), bases (CaO, MgO, K_2O, and Na_2O) are dissolved and in particular lime.

The boiling HCl dissolves the $SiO_2 + Al_2O_3 + Fe_2O_3$ more completely than the cold HCl. The difference however is not great, and in any case there is no ground for the view that the quantities dissolved in cold HCl are negligible as compared with those dissolved if boiling is effected. Hence the experimenter who does not hesitate to treat with cold HCl may also in my opinion, confidently employ the treatment with boiling HCl.

In Table V the content in Fraction I and II and the total acids ($SiO_2+Al_2O_3+Fe_2O_3$) are expressed in percentages of I and II (last column). Here somewhat considerable differences occur. In part-

TABLE. V.

Soil Sample No.	Percentage dissolved of dry substance			Total acids	Fraction I in % of dry substance	Total acids in % of I + II
	In cold or in boiling HCl	SiO_2	$Al_2O_3 + Fe_2O_3$			
[illegible]	cold	0.8	2.06	2.86	67.1	4.3
	boiling	1.11	2.60	3.71		5.5
509	cold	n. q.	n. q.	n. q.	40.2	n. q.
	boiling	0.77	1.20	1.97		4.9
1898	cold	0.42	1.24	1.66	76.3	2.2
	boiling	0.67	1.46	2.13		2.8
1900	cold	0.33	1.23	1.56	74.5	2.1
	boiling	0.64	1.53	[illegible]		[illegible]
1432	boiling	0.86	[illegible]	[illegible]	44.2	[illegible]
1433	boiling	0.68	2.52	3.20	43.4	7.4
1440	boiling	0.64	2.77	3.41	53.3	6.4

icular, taking the last three soil samples, somewhat large quantities in percentages of Fraction I and II are dissolved in the boiling HCl. These are three river clays of loamy character. A smaller total in $SiO_2 + Al_2O_3 + Fe_2O_3$ might have been expected. The proportion of $Al_2O_3 + Fe_2O_3$ to SiO_2 is however greater in the case of these three soil samples than with the other samples. Possibly here we are dealing with a soil with a high content in easily soluble Fe_2O_3.

The question now arises whether any allowance can be made for the quantities that have passed into solution with the HCl treatment. They are removed on decantation of Fraction I according to the ATTERBERG method. In particular the acid will have dissolved a good part of Fraction I. Of Fraction II perhaps a rather smaller part will be dissolved, while the Fractions III and IV, on boiling for 15 minutes with the *very dilute* HCl employed remain practically insoluble. Since the total of the acids is not large, it can without hesitation be taken into account in the case of Fraction I: that is to say, that no correction need be applied for the Fractions II, III and IV.

5. *Calcium Carbonate.* — While hydrochloric acid is mainly used by the writer, on account of its solvent action on calcium carbonate, some colleagues give a warning against the use of acids on that account. I am of the opinion that the size of the particles of cal-

cium carbonate is of great importance in judging of the soil, and that it is advisable to determine this. I am unable however to find any indication that the different fractions have been tested as to their content in $CaCO_3$.

I expressed an opinion in Rome in May 1924, that it would be advisable in the case of soils containing $CaCO_3$ to determine, by taking a second sample, the dimensions of the $CaCO_3$ particles separately. The immediate question however is, how the soil samples are to be prepared for the determination of the dimensions of the $CaCO_3$ particles. The determination of $CaCO_3$ in the different fractions involves much time. In the soil sample No. 851 the results with the methods 1 and 3 (wet and airdried soil samples, see Table IV) were nearly the same (see Table VI). In the case of this soil the $CaCO_3$ particles were already separated from each other by rubbing in water.

TABLE VI.

Soil Sample No. B. 851	$CaCO_3$ in percentage of dry substances				
	I	II	III	IV	Total
(a) moist	4.5	2.0	2.1	0.2	8.8
(a) airdried.	4.3	2.0	2.4	0.1	8.8

TREATMENT OF THE SOIL SAMPLES WITH H_2O_2 (the ROBINSON method).

The proposal of ROBINSON (5) to boil the soil samples with H_2O_2 to the point of removal of the humus involves a great advance. This is not the place to enlarge on the whole question of the importance of the H_2O_2 treatment and I refer the reader on that account to the literature dealing with the subject (9). In a later article ROBINSON comes to the conclusion that the hydrogen peroxide has the effect of completely decomposing the organic substances which have become transformed into humus, or of depriving them of water, while it leaves unaltered the fibrous organic substances such as cellulose and lignin. Hence if the microscopic remains of roots etc. are removed by sifting, the H_2O_2 treatment may be expected to remove the humus either altogether or nearly so.

How far this is really the case, will appear from the following investigation.

The preparation of the soil sample was effected by the new method, i. e. boiling with H_2O_2 and HCl and decantation of Fraction I first with H_2O and then with NH_4OH and of the Fractions II and III with water. Fractions II, III and IV of this sample were first dried at 105°C. and then ignited. Table VII reproduces the results of Fraction II. On drying at 105°C. the soil sample No. 824 gave a Fraction II of 16.04 % and on ignition, of 14.17 % of air-dried soil. The loss through ignition was thus out of 100 gm. of soil 1.87 gm.: i. e. in a percentage of Fraction II, $1.87 \times 100 : 16.04 = 11.7$ % (Table VII, last columm). The content in $CaCO_3$ and humus in dry soil is also shown in Table III.

TABLE VII.

Soil Sample No.	% of dry substance		Fraction II gm. out of 100 gm. of air dried soil		Loss on ignition on 100 gm. Soil.	Loss on ignition in % of Fraction II
	$CaCO_3$	Humus	Dried at 150° C.	Ignited		
824	11.9	3.6	16.04	14.17	1.87	11.7
463	8.7	0	8.66	7.37	1.29	14.9
465	8.7	0	8.60	7.36	1.24	14.4
849	4.8	0	16.07	14.36	1.71	10.6
1100	10.9	0	11.23	9.76	1.47	13.1
796	9.2	2.9	23.38	21.93	1.45	6.2
952	5.0	10.5	20 62	19.07	1.55	7.5
800	0	10.7	19.91	18.72	1.19	6.0
830	0	10.0	25.64	24.37	1.27	4.9
1061	0	4.0	18.47	17.52	0.95	5.1
827	0	0	19.63	18.78	0.85	4.3
828 *a*	0	0	24.37	22.65	1.72	7.1
828 *b*	0	0	23.63	21.84	1.79	7.6
569	0	8.0	29.07	27.37	1.70	5.8

On ignition of the Fraction II airdried at 105°C., a reduction thus takes place of the content in Fraction II amounting to from 0.85 to 1.87 % on airdried soil: these figures are not large. On ignition of the Fraction III and IV a still smaller reduction takes place of at most 0.6 %, but more usually of some few tenths per cent. The reduction of Fraction II on ignition clearly does not result from the undecomposed remnant of the humus left from the treatment by H_2O_2. For Fractions II of the three samples soils that are completely free from humus and $CaCO_3$, viz. Nos. 827 and

828 (*a*) and (*b*), are also reduced by ignition, and in percentages of Fraction II (4.3 ; 7.1 ; 7.6) which are not less than the other soils free from $CaCO_3$ (for example, 800 with 10.7 % of humus and 6.0 % of loss on ignition), even if these soils are rich in humus. The loss on ignition of the soils containing $CaCO_3$ expressed as percentages of Fraction II, are however, with the exception of 796 and 952, higher, even if the soil is free from humus. The inference would seem to be, that Fraction II, even on boiling with dilute acid, may still contain some carbonate. Whether this is really the case has not up to now been further investigated.

The seven soils that are free from $CaCO_3$ show on an average 6 % of loss in ignition (as percentages of Fraction II), and as this loss is not connected either with humus or with $CaCO_3$ Fraction II thus contains an average of 6 % of hygroscopic moisture (min. 4.3 % and max. 7.8 %). The differences are probably due to the composition of the Fraction, i. e. whether there is more or less weathering of the silicates.

The conclusion is thus reached that the H_2O_2 ROBINSON treatment, subsequent boiling with HCl and decantation of Fraction I with NH_4OH, entirely decomposed and dissolved the humus. Quite different results are obtained on ignition of the Fractions after the old method has been followed, viz. treatment with cold HCl and decantation of Fraction I with ammonia and Fraction II and III with water. The difference is clear from Table VIII.

TABLE VIII.

Soil Sample No.	$CaCO_3$	Humus approx.	Fractions	in % of soil: dried at 105°	in % of soil: ignited	Ignition loss in % of soil	
805	0	16 %	II	29.1	23.8	5.3	8.1
			III	29.6	26.8	2.8	
812	0	31 %	II	28.3	22.1	6.2	11.0
			III	24.3	19.5	4.8	

Fractions II contained at most 7 % of hygroscopic moisture per fraction, which is approximately in the case of soils 805 and 812 at most 2 % of the soil. The ignition loss of 5.3 + 2.8 = 8.1 % and 6.2 + 4.8 = 11 % is thus due for the most part to the humus (approximately 8.1 — 2.0 = 6.1 % and 11 — 2 = 9 %).

Originally it was my opinion that it was essential to submit

the soils containing large quantities of humus to a dull heat before the H_2O_2 treatment. It has however now been established that even when large masses of humus are present (soils with nearly 60 % of humus have been the subject of experiment) the H_2O_2 treatment can decompose them. Treatment was of course carried out on 5 instead of 10 gms of soil. Ignition was not only unnecessary but even prejudicial, as the humus that has been ignited did not decompose fully under the H_2O_2 treatment. Fractions II and III and also IV thus contained humus, and moreover the mineral particles were firmly cemented together with humus that had been ignited and had remained undecomposed on treatment with H_2O_2. On investigation of a series of clay soils containing humus in large quantities the fluid remained turbid on decantation and the results were quite different from those of the non-ignited soils with H_2O_2 treatment. See Table IX.

TABLE IX.

Soil Sample No.	Percentage in dry substance in:			
	Humus approx.	Calcium carbonate	Fraction III IV (Sand) not ignited	Fraction III IV (Sand) previous ignition
1729	39	32.3	3.7	5.0
1730	46	25.9	4.7	5.0
1735	47	5.1	2.1	20.3
1738	66	1.6	2.2	11.0
1739	58	2.4	6.0	20.4
1744	55	0.6	13.4	25.0

DECANTATION WITH NH_4OH.

In my article which has already been quoted (1) I referred on page 7 to the effect of using dilute ammoniacal water for decantation. In an article which appeared recently BLANCK and ALTEN (11) come to the conclusion that a preparation of the soil with ammoniacal water for analysis by decantation on the ATTERBERG method cannot be recommended without reservation, for all soils, as the 2.5 % of ammonia solution under certain conditions has profound chemical effects which, in the instance investigated by BLANCK and ALTEN, have led to a considerable release of silicates whereby the whole decantation result, in the sense of the originator of the method, is rendered illusory. The behaviour of the Dutch

soils in this respect has not yet been investigated. It may be noted here, that in the decantation we always use a 0.1 % ammonia solution.

Conclusions.

On agitation with a slight excess of cold dilute HCl fairly considerable quantities of $CaCO_3$ remain undissolved, which on boiling with the HCl are completely or very nearly dissolved.

Somewhat more of $SiO_2 Al_2O_3 + Fe_2O_3$ and bases are dissolved on boiling with HCl, than on agitation with cold HCl; the differences are however small. These quantities which go into solution on boiling with HCl probably belong for the most part to Fraction I. A correction in the case of Fraction II may probably stand as accepted and certainly without serious error in the case of Fraction III and IV.

On decantation of Fraction I with dilute ammonia — either after agitation or after the HCl treatment — not all the humus is dissolved. The fractions II and III (IV) may in the case of soils rich in humus contain considerable quantities of humus. On ignition of Fraction II, and also to a small extent in the case of Fraction III, hygroscopic moisture as well as humus is lost.

If the larger particles of organic substances such as the remains of leaves, roots, etc., have been removed by sifting the soil sample, the humus is practically completely decomposed by boiling H_2O_2 (Robinson method), and by further decantation with NH_4OH after boiling with HCl, or transformed into a dry form. Fractions II, III and IV are then practically free from humus. Ignition of these fractions for removal of humus is thus unnecessary. Since Fraction II still contains hygroscopic moisture, ignition of this Fraction brings out a small error.

Ignition of the soil samples, even if it is very carefully carried out, makes the organic matter harder to attack by the H_2O_2, so that after treatment of the ignited samples with H_2O_2 somewhat large quantities of humus remain in the fractions, which are not even dissolved by NH_4OH. These ignited organic remains cement the mineral particles firmly together, so that a much too low content in clay is found.

A combination of boiling with H_2O_2 (according to Robinson) and HCl and decantation of Fraction I with NH_4OH seems to be the most suitable treatment of the soil sample. The cementing

humus-$CaCO_3$-Clay-gels are removed so that a thorough separation of the mineral particles is achieved without their being affected in any way worth mention. In consequence of the ease with which separation is effected, decantation of all fractions proceeds very quickly. Boiling with more than 100 cc. 0.2 N. HCl excess is not favourable, as it necessitates more frequent decantation. From experiments which have not yet been published it has been found that with the combination H_2O_2 and HCl the carbonates dissolve more readily in the HCl.

Detailed Description of the New Method of Preparation of the Soil Samples.

10 gm. of air dried soil (in the case of soil very rich in humus 5 gm.), passed through a 2 mm. sieve are placed in the afternoon in a 750 to 1000 cc. beaker and 50 cc. of a 20 % solution of H_2O_2 poured on it. After some time frothing frequently takes place so that cooling off is necessary. On the next day the whole is boiled for 30 minutes in the bath, cooled, 50 cc. H_2O_2 again added and once more boiled for 15 minutes. If necessary the boiling with H_2O_2 may be repeated once again. Subsequently 200 cc. of dilute HCl is added with such quantity of HCl, that with 100 cc. 0.2 N. HCl more is available than is required for the solution of the calcium carbonate: boiling for 15 minutes over a naked flame follows with cooling off and the whole is washed into the Atterberg decantation cylinder. Decantation (10 cm. after 8 hours, or 20 after 16 hours), proceeds first with water till the acid reaction has disappeared, and then again with NH_4OH. After removal of Fraction I, decantation of Fractions II (10 cm. after 7.5 minutes) and III (30 cm. after 15 seconds) is effected with water. Fraction IV remains behind. Fractions II, III, and IV are dried at 105°C. and weighed. Fraction I is reckoned at 100 — (II + III + IV + Humus + $CaCO_3$).

As limits of the fractions the Atterberg limits are adopted:

Fraction	Vol. in cm.	Diameter in microns.
I	10 : 8 × 3600	< 2
II	10 : 450	2 — 20
IIIa	30 : 60	20 — 100
IIIb	30 : 15	100 — 200
IV		200 — 2000

Comparative Results according to the earlier method and the new method N.

With A the preparatory treatment is carried out with cold HCl and further decantation as above (see *Internat. Mitt. für Bodenkunde*, XI, Page 9). The new method N is that described above. Table X shows the results.

Table X.

Soil Sample No.	$CaCO_3$	Humus	Content in % of dry soil in I		II		III		IV		Proportion I : II = I	
			A	N	A	N	A	N	A	N	A	N
790	0.2	3.0	42.4	49.8	32.0	26.6	22.0	19.7	0.4	0.7	0.75	0.53
795	8.8	6.0	31.9	44.4	32.8	22.7	20.1	17.6	0.5	0.5	1.03	0.51
800	0.3	10.7	19.9	35.2	30.3	20.9	38.2	32.7	0.6	0.2	1.52	0.59
824	11.9	3.6	25.8	32.8	23.6	16.0	34.1	35.5	1.0	0.2	0.91	0.49
830	0.1	10.0	45.8	51.8	31.8	27.6	12.1	10.4	0.2	0.1	0.69	0.53
831	0.9	3.9	29.5	36.6	26.0	19.2	38.7	36.9	1.0	2.5	0.88	0.52
952	5.0	10 5	23.3	32.8	24.8	20.1	35.8	31.5	0.6	0.1	1.66	0.61
1096	1.8	1.3	19.9	25.9	19.8	15.8	52.5	51.0	4.7	4.2	1.00	0.61

According to the old method A the content in Fraction I is always smaller, in Fraction II is always larger, than with the new method N. The differences are very considerable, as also is noticeable in the proportion I : II with A and N (last two columns). The differences in the case of III (and IV) are very slight. To a very small extent the differences are to be ascribed to the fact that Fractions II and III by the A method may still contain $CaCO_3$. They arise mainly however from the fact that (by the N method) the cementing $CaCO_3$ — Humus — Clay media have been removed by boiling with H_2O_2 and HCl.

Concluding Observations.

A brief note may be added on the following points:

(a) *The form of the* Atterberg *decantation cylinders.* — Immediately after the war, new decantation cylinders were ordered. The syphon tube of the new cylinders was however differently shaped from that of the old cylinders, which occasioned great differences in the results.

Soil Sample	I + II	III + IV	I + II	III + IV
	Old form		New form	
882	11.8	83.5	16.9	78.4
883	22.9	73.6	37.2	59.3
884	12.2	85.3	18.8	78.8

The old form (2) was retained. If the ATTERBERG decantation apparatus is to be adopted as the standard apparatus (12), it will be necessary to place the order for the instruments with one and the same firm.

(b) *Angle of inclination of the plane of setting up of the decantation cylinder.* — A portion of the soil particles as they settle are deposited in the front limb of the syphon tube of the cylinder. It seemed likely that these particles, at least in part, would be floated off. In order to prevent this, the Fraction I was always in the first place syphoned off very slowly, in 10 or 15 minutes. Later on the plane surface on which the cylinders stand was given a slight inclination of 3°, and in such a way that the syphon was somewhat raised. Contrary to our expectation we found that in this way rather more of Fraction I was decanted.

Soil Sample No.	Angle of Inclination	Fraction (average of 6 determinations			
		I	II	III	IV
B . .	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	3°	[illegible]	28.8	15.1	[illegible]

In the case of very sandy soils the results, especially for the sand fractions, were much altered :

Soil Sample	Angle of Inclination	Fraction			
		I	II	III	IV
960	[illegible]	2.0		[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]
961	[illegible]	2.2		[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]

The separation of fractions III and IV is probably better effected with the KOPECKY apparatus. In the case of a series of very sandy soil samples a complete separation of the fractions III and IV cannot be successfully effected.

(c) *The rate of decantation and the size limits of the fractions.* — Following ATTERBERG decantation, the point of removal of Fraction I takes place with a height of water in the cylinder of 10 cm. after 8 hours (or 20 cm. after 16 hours). In the STOKES equation :

$$V = K \times r^2$$

which is naturally only true for spherical particles, thus becomes $V = 10 : 8 \times 3600$ and $r = 0.0001$, which gives $K = 34722$. The other two rates of decantation by the ATTERBERG method are $V = 10 : 450$ and $V = 30 : 15$, which with $K = 34\,722$ gives $2r = 16\mu$ and $2r = 152\mu$. The ATTERBERG fractions thus would lie between the following limits :

Fractions		Dimensions in Microns
I	< 2	2
II	2– 16	instead of 2– 20
III	16– 152	» » 20– 200
IV	152–2000	» » 200–2000

We have however always retained the limits of the fractions as stated by ATTERBERG (2 — 20 — 200 — 2 000 as in the last column of the above table). It is essential in each case to mention the rate of decantation in use.

(d) *The* SIKORSKY *decantation apparatus.* — SIKORSKY decants after 1000 seconds and with a height of water of 20 cm. : thus $V = 20 : 1000$, which with $K = 34\,722$ gives a diameter $2r = 15.2\mu$. The so-called clay fraction of SIKORSKY is thus nearly equal to the fractions I + II of ATTERBERG, which we found to be established for a large number of soil samples. The SIKORSKY apparatus is very rapid in working. If therefore it is a question of a large number of soil samples of the same type the sand content (size of particles $2r = 15$-16) may be determined according to SIKORSKY and then an exact mechanical analysis made of some typical soils into Fractions I, II, IIIa, IIIb and IV.

B. SEDIMENTATION METHOD.

(ODÈN-WIEGNER and KRAUSS-ROBINSON).

Some brief observations on the sedimentation method may be made here. While in the decantation method the electrolytes present in the soil or added to it are removed by decantation of Fraction I together with a part of Fraction I, the removal of these electrolytes in the case of the different sedimentation methods must take place *before* the sedimentation and without any removal of particles of Fraction I. Thus there must be filtration and washing out with distilled water before the sedimentation. A short time ago MIECZYNSKI and SOKOLOWSKY (13) pointed out that in the separating out of the soil particles a reversible process was involved, so that as in all reversible reactions the freed particles must be removed. In this case it will be necessary to treat the mass of soil afresh after the filtration and washing out, for example, by agitation with dilute ammoniacal water.

Of the various sedimentation methods I have had personal experience only of the pipette method according to ROBINSON (14). The following detailed observations thus apply only to the ROBINSON method and the KRAUSS similar method (15).

1. In the ATTERBERG decantation method Fraction I is estimated from the difference (100 — ($CaCO_3$ + Humus + II + III + IV)). Since the quantities of SiO_2 $Al_2O_3 + Fe_2O_3$ and other bases dissolved in the course of the treatment with HCl originate mainly from Fraction I, no correction is necessary. In the sedimentation methods Fraction I is weighed, and hence a correction must be made for the substances which are dissolved in the course of the HCl treatment.

2. The same holds good, if the fractions are ignited instead of being dried at 105°. Fraction I in particular contains much hygroscopic moisture, so that on ignition of this fraction there may be a fairly large error. In the case of very clayey soils there may be found up to approximately 5 % of hygroscopic moisture (in percentage of dry soil).

In Table XI some comparative analyses made by the ROBINSON pipette method and the Groningen method are placed side by side. The preparatory treatment by the pipette method was carried out by the new method, viz. H_2O_2-HCl treatment. According to a verbal account given by ROBINSON the material was then filtered

and washed out with H_2O, the whole mass of soil placed in a litre flask with 500-600 cc. of water, mixed with 50 cc. of 10 % ammoniacal water and agitated for three days. This soil washing was then filled up to one litre with water, thoroughly shaken and placed in a cylinder. Pipetting was then employed at the 20 cm. level after 15 minutes (V = 20 : 200, hence the ATTERBERG fractions I + II) and at the 20 cm. level after 16 hours (V = 20 : 16.3600) hence the ATTERBERG fraction I. Fraction I + II and I are dried at 105° and not ignited. The loss from ignition has all the same been estimated and is inserted under G in the last column of Table XI. In the liquid filtered off after the HCl treatment, SiO_2. Al_2O_3 + Fe_2O_3 and CaO were identified and inserted on Table XI in K as value in a percentage of the soil. This correction is taken into account, i. e. that Fraction I is already increased by that value. If this correction K is not made and if moreover the fractions are ignited instead of dried at 105°, the following results are obtained, for example in sample No. 795, by the ROBINSON pipette method (R) : I = 37.2 (instead of 46.2), II = 21.5, III = 26.5, (instead of 17.5). The effect is thus very noticeable in the case of these heavy soils.

TABLE XI.

Soil Sample No.	Content in percenteges of dry soil in									
	$CaCO_3$	Humus	Fraction I		Fraction II		Fraction III + IV		K	G
			Gr	R	Gr	R	Gr	R		
509	4.0	1.5	24.9	26.8	15.3	12.4	54.3	55.3	2.0	3.9
795	8.8	6.0	44.4	46.2	22.7	21.5	18.1	17.5	3.7	5.3
1898	0.4	2.5	47.2	47.6	29.1	26.1	20.8	23.4	2.8	4.7
1900	0.2	3.0	46.2	46.5	28.3	24.9	22.3	25.4	2.0	5.3

There is a fairly close correspondence; in comparison with the correspondences usually existing between similar analyses it may be called very close. It is to be hoped that ROBINSON will issue precise instructions for the use of his pipette method, and will give particular attention to the following points: (1) treatment with cold or boiling HCl; (2) correction K; (3) ignition or drying at 105° of the Fractions.

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(1) *Int. Mitt. f. Bodenkunde*, IV, pp. 7-18, 1914.

(2) *Int. Mitt. f. Bodenkunde*, II, pp. 320, 1912.

(3) A. D. HALL, *J. of the Chemical Society*. Transactions 1904, Vol 85, Part II, 950 and 946.

(4) *Int. Mitt. f. Bodenkunde*, XI (1921), Pagè 9.

(5) GILBERT WOODING ROBINSON, M. A.; Notes on the Mechanical Analysis of Humus Soils *Journal of Agricultural Science*, XII, pp. 287-291, 1922.

(6) KÖNIG and HASENBEUMES have criticised this method in the *Landwirtschaftlichen Jahrbüchern* (Agricultural Yearbooks) LVI, 1921 page 449). On page 443 emphasis is laid on the fact that to avoid flocculation of the soil colloids distilled water must be used for the decantation of the first fraction, and that on this account the use of HCl as by HISSINK gives rise to errors. They have obviously failed to note that the decantation of Fraction I is carried on with distilled water until the electrolytes are removed. This stage in the process is recognised by the fact that the suspended matter in the cylinder becomes markedly turbid.

(7) The figures supplied by KÖNIG (see edition 1923, page 112) have only relative value.

(8) The STOHMANN litre flasks were employed, as in the analysis for superphosphate.

(9) In this periodical, Part I, page 6, an article by Dr. L. SMOLÍK appears on the hydrogen peroxide catalysis of the Moravian soils.

(10) *Journal of Agricultural Science*, XV, Page 29.

(11) Ein Beitrag zur Frage nach der Vorbehandlung der Böden mit Ammoniak für die ATTERBERG'sche Schlämmanalyse by E. BLANK and F. ALTEN; *J. f. Landwirtschaft* (1924) Page 153-163.

(12) See Resolution 4 of the Berlin Meeting. *Int. Mitt. f. Bodenkunde*, IV, Page 30.

(13) Die Untersuchungen über den Einfluss verschiedener Vorbereitung der Bodenprobe auf den Verlauf des Schlammprozesses by F. MIECZYNSKY and MAYAN SOKOLOWSKI. *Mémoires de l'Institut national Polonais d'économie rurale à Pulaw*. Vol. IV, 1923, Summary 109-111.

(14) GILBERT WOODING ROBINSON, A new method for the mechanical analysis of soils and other dispersions; *The Journal of Agricultural Science* XII, 306-321, 1922.

(15) GUSTAV KRAUSS, Ueber eine neue Methode der mechanischen Bodenanalyse etc. by *Int. Mitt. f. Bodenkunde*, XIII, pp. 147-160, 1923.

THE DEGREE OF SOLUBILITY OF PHOSPHATE AND POTASH FERTILISERS NECESSARY TO MAINTAIN THE SOIL SOLUTION AT THE CONCENTRATION REQUIRED BY PLANTS.

Phosphorus and potassium are necessary to plant life and if these two elements are lacking, plants, after having assimilated the small quantity of phosphorus and potassium contained in the seeds, lose their vitality and die.

Phosphorus and potassium are deficient in most soils, except those of volcanic origin ; hence the necessity of supplying non-volcanic soils with the quantity of phosphorus and potassium necessary for plant life.

Phosphorus is contained in large quantities in the natural phosphates, and potassium in rocks of the leucite and phonolite type.

Phosphorus and potassium, in order to be absorbed by plants, must be dissolved in water. It is also necessary that these phosphate and potash solutions should contain only a minute percentage of dissolved matter ; for instance, a one per cent solution ceases to be nutrient and becomes toxic, and the plant in contact with it withers and soon dies.

The optimum *total* saline concentration of nutrient solutions for wheat, for instance, has been found to be 0.3 parts per 1000. A solution of this concentration, however, contains such a small quantity of dissolved nutrient substances, that the plants would soon exhaust them, when plant life would become impossible.

In order that this very weak solution should not become impoverished, an intermittent supply of nutrient salts is necessary, which would replace only those substances in the solution as they become exhausted or deficient, and in such quantities as to reach, but not exceed, the necessary concentration.

This may appear to be an unattainable ideal, and yet it is realised to a considerable extent in naturally fertile soils, and the process may be regulated by a far from complicated method.

No chemical transformation of the crude phosphatic or potassic substances is necessary, it is sufficient if they be finely ground and well mixed, and applied to the soil in the same quantities and in the same manner as is done in the case of other chemical fertilisers.

The mineral phosphates alone are too insoluble, *i. e.*, they give

solutions which are too weak; when merely mixed with crude potassic compounds they become much more soluble in water and give stronger solutions than when alone (a chemical phenomenon of double decomposition), and of the strength required by plants (*Proceedings of the IV International Pedological Conference* — Report No. 20 — Commission II).

As the mineral phosphate is brought to the optimum degree of solubility by the presence of the slightly soluble potassic salts of the leucite type, so these potassic salts attain the required solubility by the presence of the raw phosphate.

The degree of solubility adapted to plant life is thus attained; it follows that in applying the mixture to the soil, if the soil solution is too weak it would quickly be strengthened to the desired degree, which cannot be exceeded as the mixture cannot give stronger solutions.

By the presence of the mixture in the soil, therefore, every decrease of nutrient phosphatic and potash salts in the soil solution, from whatever cause, would be followed by a corresponding increase, and the percentage of phosphorus and potassium in the nutrient solution would remain constant and retain that value which is adapted to plant life.

Thus, by simply grinding and mixing, the natural phosphates and volcanic rocks of the leucite type are made suitable for fertilising purposes, and from both a scientific and economic point of view the method cannot be improved.

The present system of chemical fertilising dates back to 1840 and corresponds to the scientific knowledge existing at that time.

It was only known then that plants derived nutriment from the matter dissolved in the soil water; it seemed that the optimum must be attained by transforming the mineral phosphate into a compound which would dissolve in water like the more soluble salts.

The mineral phosphate was treated with sulphuric acid, and a mixture was obtained of double the weight of the original substance and of which about 50 % was chalk and very acid phosphate. This mixture, owing to the large quantity of sulphuric acid necessary and the cost of manufacture, cost about four times as much as the original phosphate. The name of superphosphate was given to this mixture (it does not contain the slightest trace of superphosphate) and its property of dissolving in a small quantity of water was thought to be a great advantage in agriculture. Erroneously, it

was said to dissolve completely because very soluble, as though the slightly soluble matter did not also dissolve completely. The difference between very soluble and slightly soluble, consists only in the fact that the former needs less water than the latter to dissolve completely, and that consequently if the former is not in contact with large quantities of water it gives very strong solutions, whereas the latter whatever be the quantity of water gives weak solutions.

When the dissolved substance is taken (as, for instance, by plant absorption) from these weak solutions, obtained from slightly soluble substances, other matter immediately dissolves, bringing back the solution to its original strength, this process continuing until the soluble substance is exhausted. Hence, the whole of the said substance is completely dissolved and utilised in its best form, for the plant is thus always in contact with the dilute solution best suited to it.

Now that it is known that strong solutions are not an advantage but an absolutely toxic factor for plants, the "superiority" of the highly soluble salts gives way to that of the slightly but sufficiently soluble substances. As the slightly but sufficiently soluble salts cost about a fourth of the highly soluble, this information should be made known to farmers in order that in their own interest and in that of the nation they should take measures towards a more scientific fertilisation of their land.

Mention should be made of the following advantages which may also be derived from this solution of the problem of chemical phosphatic and potassic fertilisation:—

The utilisation of all phosphate deposits, on the sole condition that their phosphorus content be not so low as to render their transport inconvenient. In Italy, the utilisation of Italian and Lybian natural phosphates is made impossible in agriculture, not because they are of poor quality, but because they are rejected by the superphosphate industry. These phosphates indeed contain on an average more phosphorus than those existing in superphosphate. Too much sulphuric acid however would be required to convert it into acid phosphate (superphosphate) as it contains a deacidifier, carbonate of lime (a valuable substance for agricultural soil), in larger quantities than the French African phosphates.

The proper utilisation of the deposits of slightly soluble potash (in Italy they are of the leucite type):

No increase in the weight of mineral phosphate, as caused for

the mere object of dissolving the phosphate ; in superphosphate the weight is double ;

The fresh impetus given to chemical fertilisation, an enormous quantity of sulphuric acid being no longer necessary (the annual requirement in Italy is at present about six million quintals);

No detrimental effect of the fertiliser on acid soils, or on those deficient in carbonate of lime. The use in agriculture of potassium and phosphorus in their natural state, at about half the present cost of phosphates.

By bringing about and maintaining the concentration of soil solution to plant life, as shown by soil science and plant physiological research, it is evident that all the characters in plants most useful to us will be reinforced, and both the quality and quantity of agricultural production will be increased.

ROMUALDO AVATTANEO.

Abstracts and Literature.

General.

Animal Life in Deserts.

BUXTON, P. A. *Animal Life in Deserts*, published by Edward Arnold and Co. Price 10s. 6d. London, 1923.

The notes on desert climate in the first chapter should be of interest to the soil scientist. All the climatic factors are treated ; water, temperature, relative moisture, wind, evaporation and light. The second chapter describes the soil and the water courses in their relation to the fauna, the subject being handled with special vividness.

When the author goes on to show that dune-sand, resting on impermeable rock, is especially indicated for grape-growing and gives as an example the region south of Jaffa (Page 42), it would seem that the possibility of cultivation in that particular spot is due to the fact that the dune sand rests partly on a so-called "Chowrah" of red earth, and in many places it is of such recent origin that signs of previous cultivation can be observed in the subsoil.

The third chapter describes the flora, while the fourth and fifth are devoted to the fauna and the physical conditions of their surroundings. The sixth chapter deals with the relations between animals and plants, and the seventh contains certain observations on the colouring of desert animals.

The author is well acquainted with the desert of South-west Per-

sia, Lower Mesopotamia, Syria and Palestine. It is impossible to deal in a brief note with the full detail which is of great interest. The value of the book is increased by the excellent photographic reproductions. The first edition is exhausted.

REIFENBERG.

Geology.

POTONIÉ. R. and SEITZ. O. in collaborations with other experts. *Bucherei für Landwirte*, edited by H. v. LEUGERKEN. Published by Walter de Gruyter and Co. 150 illustrations, 274 pages. Price 10m.80, Berlin-Leipzig, 1925.

The agriculturist, like the engineer and the miner, has the right to expect that geological knowledge shall be available for him in a form and to an extent such as fall naturally into the framework of his scientific education and in some relation to the work which comes to him in the course of this vocation. The present volume " Geologie ", in the " Bücherei für Landwirte " series, meets this requirement, as besides giving the general scientific principles of general and historical geology, it treats in full detail the subjects especially important for the agriculturist, such as the transformation of rocks, weathering and soil formation, soil water, etc., while dealing with the theory of stratification, and more especially with palaeontology as shortly as is compatible with any kind of geological studies and the comprehension of geological maps. The authors have hereby taken the best line that a " Geology for Farmers " can take, so that the book is undoubtedly one to recommend. It contains a series of instructive diagrams ; but it would have been advisable to have added a geological outline map or a rough sketch of a geological land map. SCHUCHT.

Soil Morphology and Agricultural Science.

SACHAROW, S. Prof. *La Pédologie*, NOS. 1-2, MOSCOW, 1924.

1. The results of the examination of soils should be utilized to a much greater extent by scientific agriculturists.

2. In practice, agriculturists are mainly concerned with soil morphology and topography. All knowledge of the soil begins with the knowledge of soil morphology.

3. Of all the subjects included under soil science, soil morphology is the one that can be chiefly applied to agricultural practice.

4. It is therefore desirable that both theoretical and practical instruction in the subject of soil morphology and soil topography should be given in the form of higher school courses, and that both laboratory and field work should be carried out.

Author.

Peat and its Applications.

STEINERT, Joh., Ing. Chem. Der Torf und seine Verwendung. Published by Walter de Gruyter and Co. Berlin and Leipzig, Goschen Series, Vol. 895, 66 illustrations. 1925 : Price 1.25 Marks.

In this book all essential information as regards peat and the uses of peat has been put together in small compass by an experienced hand. The

scientific section deals with the origin and different kinds of peat, as well as its physical and chemical properties ; the technical section describes the preliminaries of the enclosure of moorland, the removal of the peat from the moor, transport and drying. Further treatment and uses and possibilities of development are also discussed. SCHUCHT.

Properties of the Soil and their Improvement as a Basis for a general Farming Scheme.

VITINS, J. (J. WITYN) 32 pp. (Lettish). Riga, 1923.

In consequence of the land reform in Latvia there has been a great increase in the number of medium-sized farms (14-16 hectares). On some of the farms improvement of arable land has been carried out with the following results as to quality of soils : Class I to II, less than 0.5 %, Class III, 4 % ; Class IV, 13 % ; Class V, 28 %; Class VI, 18 %; Class VII, 2 %. A large number of determinations of soil reactions, in all more than 600, went to show that, speaking generally, only the soils of Classes I to III are completely or nearly neutral ; that the soils of Class IV often require lime, although good yields may be obtained from them by careful cultivation and plenty of manure. All the other soils, i. e. 87 % of the total, respond to treatment with lime, especially from Class IV onwards. The majority of the farms have poor, highly "podsolic" soils, the average yields of which are from 7-12 quintals per hectare. It is difficult for the farms to maintain existence with such yields, nor can any satisfactory scheme of farming be established. The strongly podsolic soils are usually found in regions with heavy rainfall (more than 600 mm.), while on lighter mother rock they occur everywhere. The first steps to be taken by the landowners and also by the authorities for the improvement of these soils must be in the direction of diminution of acidity. This treatment should not present difficulty since there is an abundance of calcareous material in Latvia. The treatise contains numerous soil analyses and descriptions of good soil requiring no lime, and also of the poor soils with high lime requirements. L. FREY.

Short Manual of Soil Science for the Use of Surveyors and Agricultural Technicians.

VITINS, J. (WITYN, J.), 110 pages (in Lettish). Riga, 1923.

The author gives in this book a general outline of the science of Pedology together with a description of the most important mother rocks of Latvia and of the soils formed from them, i. e. of the extent of the transition of soils into the podsol type. The degree of podsol formation may be considered as a basis for improvement of new, recently cleared soils.

The soils of Latvia are divided into 8 principal categories as regards improvement. The fertility of the heavy clay soils and of the sandy soils is markedly diminished by transition to the podsol type, in the sandy soils by the formation mainly of a smooth very acid horizon of "Ortstein". The fertility of the sandy clays with a clay content of 10-30 %, is dimi-

nished only very gradually, but the yields are much reduced if the lime requirement of the soils is about 6 tons $CaCo_3$ per hectare.

The author recommends that special attention be given, when undertaking improvements, to the development of the soil profiles, to the colour, structure and the soil water conditions. In particular, attention is to be paid during improvements of soil which is rich in humus. Richness in humus of soil in the Podsol zones is either the sign of neutral soil — the yields in this case are very high if the subsoil is not too coarse-grained — or the sign of poor aeration and the proximity of soil water — in the latter case, the soils are of little value as arable land although well suited for artificial meadow and pasture.

The content in organic matter of the higher categories of arable land is about 1-2 %, and only reaches 4 % in the non-podsol soils : in the lower categories it often falls below 2 %, usually it is about 3 %, although these soils are much lighter in colour. L. FREY.

Experiments with Subsoiling, Deep Tilling and Subsoil Dynamiting.

The Illinois Experiment Stations Bulletin, No. 258.

Deep plowing and subsoil dynamiting experiments in Illinois, as well as in other States, indicate that these tillage methods cannot be expected materially to increase crop yields. That such methods are not superior to ordinary or medium-depth plowing has been indicated by subsoiling experiments conducted by the Illinois Agricultural Experiment Station on grey silt loam on light clay at Odin, Marion county : subsoiling, deep tilling, and dynamiting experiments on grey silt loam on light clay at Toledo, Cumberland county ; and deep tilling experiments on brown silt loam at Urbana, Champaign County.

Soil moisture determinations made during two seasons on the variously tilled plots at Toledo show that none of the tillage treatments used increased the downward movement of moisture through the soil.

X

Soil Pysics.

The Temperature of the Surface of Deserts.

The Buxton P. A. *Journal of Ecology*, Vol. XII, No. 1. January. 1924

The author while studying animal life took up the study of the temperature of desert soils. There is no difficulty in the estimation of the temperature of light soils, whereas heavy soils present various obstacles. When working on gravel or lava soils, the author has overcome the difficulties of the ordinary thermometer by the utilization of a thermometer in the form of a wax scale, with different melting points. In June and July the temperatures of the soils of Palestine are between 55 and 62°C. While theoretically the temperatures of the soils in the Jordan valley, which in some cases are over a 1000 m. below the elevation of Jerusalem, should be lower than the temperature of the mountain soils (due to the

fact that the sun's rays are absorbed by atmospherical vapours), in reality the contrary is the case. The author states that this is caused by the walls of the valley which act as reflectors of the sun's rays.

The author has also found that the slope of the ground has an important bearing upon temperature. REIFENBERG.

Note on Capillary Rise in Soils.

GAROLA C. V. and CHARTRES. Etudes sur l'ascension capillaire dans les sols. *Annales de la science agronomique*, No 1, pp. 1-32, graphs 192[illegible].

These notes of the late agronomist have been compiled by Mdlle Garola, his collaborator.

The first chapter deals with the calculation of the probable height of capillary rise, dependent upon the diameter of the tubular passages and consequently of the soil pore spaces, using the following formule :

$$h = 2\,f : dr.$$

h = the height in mm. ; f = surface tension of the liquids ; d = its density ; r = radius of tube in mm.

As there are, per gm. of soil, 43 milliard grains of raw clay (of a diameter 0.000270 cm.) ; or 34 million grains of silt ten times larger ; or 5 thousand grains of sand of half a millimetre.

Consequently these last are not concerned with capillarity.

Chapter II deals with the experimental determination of capillary rise in different soils, by the use of an apparatus which resembles the "Evaporomètre enrégistreur" of HOUDAILLE. The experiments refer to sand, silt and silicious clay.

In sand, water rises very quickly but only to the small height of 55 cm. after 3 days and remains at that height.

On the other hand, in the silts of the high plains of the province of Beauce the absorption is slower at the beginning but continues during a week and reaches a height of nearly 80 cm.

In the sample of silt from Lomas de Zamora near Buenos Ayres and in silicious clay, the capillary rise is considerably slower, as the water takes 191 days to attain the height of 1 metre.

In the last experiment the heights reached after equal intervals of time represent a logarithmic scale. The quantity of absorbed water follows a similar curve.

The data of experiments are as follows :

	Percentage of clay present	Time required to reach 0.50 m.	Relative speed.
Silt without clay	0	12 hours	100
» from Beauce	18	37 »	33
» » Zamora	[illegible]	[illegible] »	[illegible]
Silicious clay	37	570 »	2

If there is more than 18 % clay the capillary rise takes place as in the case of pure clay, because it fills all the empty spaces and thus the diameter of the capillary tubes is determined. PIERRE LARUE.

New Apparatus for Determination of Soil Permeability.

SPIRHANZL, J. *Zemedelsky Archiv.* Prague, 1924.

A sample of the soil is taken by means of a steel cylinder. This column of soil, having a height of 10 cm., is subjected to the penetration of water at a constant hydrostatic pressure. The relative permeability of the soil is expressed in cc. of water which have penetrated the column of soil having a basal area of 10 cm^2 and a height of 10 cm. and with a hydrostatic pressure of 100 cm., for a period of 24 hours. SMOLÍK.

Soil Chemistry.

Researches on the Formation and Decomposition of Humus in the Soil.

BALKS, R. Untersuchungen über die Bildung und Zersetzung des Humus im Boden. *Landwirtschaftliche Versuchstationen*, 103-221. 1925.

The catalytical power of the soil produced by enzymes and colloids is increased by the use of farmyard manure when it is first applied, but later on diminishes. The same effect is shown with pure nitrogen and its easily soluble compounds; after the use of dung the effect first increases and then diminishes. The author states that the amount of carbon found in the soil is less after oxydation with an aqueous solution of chromate than that found in a preliminary analysis. The experiment with chromate of silver, carried out by von SIMON, corresponds with the results of the analysis. The experiment carried out by PIETTRE with the pyridin method proved less successful. TOLLENS method for the determination of pentozans in the soil is useful, but no suitable method has yet been established for the investigation of hexosans. The methoxyl data given by ZEISEL and FANTO show the amount of lignin in the soils. The gradual oxydation of the humus was shown by a slow decrease of the carbon content after the application of farmyard manure. The author observed that the quantity of humus decreases more slowly in chalky soils than in soils with little chalk. This observation differs from the general opinion hitherto held, but is in accord with the experiments of ZOSSOWITSCH and FRETJAKOW. This phenomenon can probably be explained by the fact that the soil acids are combined with the excess of calcium carbonate and are thus protected from rapid oxydation.
K. SCHARRER.

Chemical Decomposition in the Egyptian Deserts.

BLANK C. and PASSARGE S. with the co-operation of RIESE, A. and HEIDE F. University of Hamburg. Die chemische Verwitterung in der ägyptischen Wüste. *Abh. a. d. Gebiete der Auslandkunde.* Vol. M, Serie C. Naturw. V. 6. Hamburg, Komm. Publ. by L. Friedriechsen u. Co. 1925.

In this book, PASSARGE gives illustrations of materials collected in Egypt in 1914, dealing with researches in soil experiments. The ana-

lysis of PASSARGE's experiments have been carried out by C. BLANK and collaborators in the Institute of Agricultural Chemistry and Soil Research at Göttingen University.

The first part deals with the geological formation of the territory travelled over and of the phenomena of decomposition of the soil. Then follows a full description of the Assuan plain. PASSARGE classifies his results as follows: In the Egyptian deserts are found various soil strata in a state of decomposition lying anderneath the superficial layer which was formed by alluvial deposits. The decomposition is apparently caused by the corrosive action of salts, which absorb and retain great quantities of water, due to the fact that the rainfall is sometimes very heavy. These decomposed soil strata found underneath the superficial layer, formed by alluvial deposits, have a depth similar to that of the soil strata found in Germany under dense vegetation, which is from 10 to 50 cm. Even the most resistant rocks, such as granite, gneiss, quartz, etc. are altered into an ashen, salty dust by the corrosive action of the salts.

All stony particles in the decomposing layers of earth are thickly covered with a reddish, or yellowish-brown dust. When such stone particles are transported to the surface they become darker, due to the loss of water, which is caused by the absorption of moisture by the sun and warm winds. These stony particles when exposed to the air for any length of time undergo a further decomposition both mechanical and chemical. In the first case, mechanical, the change is caused by the temperature variations. In the second case, chemical, it is brought about by the penetration of the salty-yellowish dust into all the fissures and crevices of the stony soil, which causes the breaking away of scales and all sharp particles. Smooth surfaces, such as for example, the old Egyptian blocks of stone, for a long time are not affected by any corrosive action, or decomposition. On the other hand, rough surfaces such as pieces of shale-like rock decompose very readily when exposed to the air, owing to the penetration of the dust into the fissures, as occurs in Germany in rocks found under moss.

The conclusion of the first part of the article can be summarized by the statement, that, the Egyptian Desert may be considered as a region of important chemical decomposition. In the second part C. BLANK supplements the information of the chemical decomposition of the Desert already known, and in the third part deals with research work concerning decomposition in Egyptian deserts.

The results can be briefly stated as follows:

(1) Chemical decomposition in the deserts is progressing at a much greater rate than scientists in the past believed to be the case. Especially to be noted is the diminishing of silicic acid and the rapid decomposition of calcium silicates, in contrast to the greater resistance of sodium silicates. This contrast is to be found in nearly all rocks and their products of decomposition, and characterizes the process of decomposition by definite features.

(2) Of the soluble salts that may cause crust or concretion formations, it is found that gypsum and sodium chloride are the most prevalent; while there are other sulphates, they are only found in small quantities. Calcium carbonate and other carbonates are in such small quantities that they need not be considered.

This statement agrees with the theory of FUTTERERS in so far as a a small percentage of NaCl and $CaCO_3$ on the one hand and a predominance of sulphate on the other, but not Na_2SO_4 but $CaSO_4$°.

(3) The zone in which gypsum is found according to BLANCKENHORN ends in the South in the neighbourhood of Thebes, but through the investigations described in this article it is further extended to the region of Assuan.

(4) The so called " Protecting crusts " which are principally composed of iron or manganese, are consequences of some internal force or action and are not caused by any external agents.

(5) In the Schellal Desert the soil formation may be considered as semi-arid and in some places is even humid. These soils are of silicate decomposition products similar to those of laterite. Contrary to expectations, the investigations have been unable to prove that the soils of the desert are of an extremely arid nature.

(6) There are two different theories in regard to the formation of ithese soils: first, that the decomposition is caused by the action of chemical agents that rarely appear, but when they do, the reaction is violent and definite; secondly, that in some remote period during formation of the soils, there existed a very humid climatic condition. In regard to the first supposition, no satisfactory proof can be offered by us, because our present knowledge of the reaction of the chemical agents found in the desert is not sufficient. The possibility of attributing the decomposition to the rains, which are of high temperature, although very rare, is a unanswered question. Also, can it be attributed to the influence of dew, the crystallization of salts, the influence of ozone, of nitrates or similar agents? Other authors have declared these to be determining agents in this process of decomposition, but we have no proof of this.

Taking into consideration all the above mentioned theories: we are of the opinion that the decomposition is rather caused by a former humid period, as the layers of soil and their chemical composition substantiate this theory. It is quite possible that after this humid period there developed an arid period and this is more or less substantiated by leading authorities on the subject to-day. However, in view of the available information on the subject we are of the decided opinion that the question of decomposition in purely arid places is a problem yet to be solved. This is in great part caused by the fact that up to the present time we have not had the opportunity to carry out researches in a region which has been shown always to have been arid.

SCHUCHT.

A Chemical Examination of Sand from the Mediterranean Coast of Palestine.

BRAVER, A. I. Die Resultate einer chemischen Uuntersuchung des Sandes an der Mittelmeerkuste Palastinas *Zeitschrift der judischen Gesellschaft fur Landeskunde und Archaologie Palastinas*, Vol 1, 2-4, 148 (Hebrew) Jerusalem, 1925.

The results of the analysis was first published in Volume 9 of the "*Economic Data of the Department of Commerce and Industry of the Zionist Executive*" in Jerusalem. It includes the analysis of 187 samples of sand of the dunes along the coast of Palestine between Ras Nakura and Rafa.

The author finds a relation between the sand and the rocks from which sand is formed, a relation which was to be expected. The conclusion that the sands in the south of Akko contain more silicates and less chalk and ferric acid is in perfect harmony with the opinion in ancient history to the effect that in this region the Phoenicians manufactured glass. Tyre and Sidon are situated at a small distance from Akko but the soil in the immediate neighbourhood of these towns is not suitable for glass manufacture. REURENBERG.

The Effect of Iodine on Soils and Plants.

BRENCHLEY Dr. Winifred E. *Annals of Applied Biology*, XI, pp. 86-111, 1924.

In pot cultures iodine in NaI solution in quantities of 0.1 to 0.0008 gm. per kg. of moist soil has been shown to affect the germination and growth of tomato (*Lycopersicum esculentum*), mustard (*Sinapis alba*), and barley (*Hordeum*) to slightly varying degrees. Germination of tomato seeds in rich soil was not affected, but loss of seedlings from "damping off" was not reduced.

Germination of Mustard was inhibited or checked by the higher concentration; of the plants that recovered some gave greater green and dry weights than the untreated plants. Barley was less resistant to any toxic action of iodine.

Bacterial numbers fluctuated, but in no definite direction, and there was no evidence of partial sterilisation with dressing of iodine in NaI solution in quantities of 0.00095 gm. per kg. of moist soil.

P. H. H. GRAY.

Soil Acidity and its Relation to the Production of Nitrate and Ammonia in Woodland Soil.

CLARKE, G. R., *Oxford Forestry Memoirs*, No. 2 (p 27, 1 plate. Oxford, 1924.

The production of nitrate in the soil is essentially a process of biological oxidation, which takes place in three stages: the decomposition of organic matter for the supply of ammonia; and the oxidation of the latter into nitrous- and of the last-mentioned into nitric acid. It is generally

held that the formation and subsequent accumulation of nitrates in the soil is in some way related to the scarcity of acidity in the soil itself.

The tests made by the author in woodland soils show that in reality soil acidity has a certain influence on the accumulation of ammonia and nitrates. The former accumulates much more in very acid soils than in slightly acid or neutral ; in very acid soils however it is liable to rapid fluctuations ; the soil has the greatest power of retaining ammonia under certain conditions of moisture.

Nitrates are found in appreciable quantities in very acid soils and are apparently unaffected by seasonal changes. In less acid soils they tend to reach a minimum towards August They do not vary to any extent during the day. A. F

The Necessity for Improvement in the Chemical Analysis of Agricultural Soils.

MARCHADIER and GOUJON. De la nécessité d'une évolution dans l'analyse chimique des terres arables. *Annales de la Science agronomique*, I, pp. 32-64. Paris, 1925.

After having made general observations concerning micro-organisms and parasitism in relation to chemistry the authors compare the methods of analysis by solvents.

As regards potash in particular, the analysis of 16 different soils demonstrate that the quantities required for treatment with hydrofluoric acid and with nitric acid vary from 1.3 to 10, which makes it almost impossible to compare results. Investigations on soil reaction show satisfactorily the amount present of lime and magnesia. But the acidity only appears at the rate of less than 1 per 1000 in relation to the base where iti s necessary to add lime at the rate of 5 per thousand

According to the authors the relation between phosphoric acid, nitrogen and potassium should be expressed as follows :

$$\frac{N + P_2O_5}{K_2O} = 0.8$$

Also the relation chalk soluble in HNO_3 magnesia soluble in HNO_3 should be equal to, or higher than unity.

Very little is knowns about silica, aluminium and iron in this connection

The sulphur content in soils varies very much.

In regard to the function of manganese, the authors have come to no definite conclusions.

The formula $\frac{\text{total } K_2O}{\text{total } Na_2O}$ is always higher than unity.

This work show the great progress that has been made in the study of the practice of agriculture. PIERRE LARUE

Biochemical Studies on the Acidity of Forest Soils.

NEMEC and KVAPIL. Biochemische Untersuchungen über die Azidität der Waldboden. *Veröffentlichungen des Landwirtschaftsministeriums*, No. [illegible]. Prague, 1923.

Having determined the effective and exchangeable acidity (by the colorimetric method of MICHAELIS) and the catalytic power of different forest soils, the authors have come to the following conclusions :

(1) The soil of a dense, evergreen forest shows a greater acidity than a deciduous forest of the same region. The degree of acidity of the humus layers of soil under closely wooded conifers is always higher than that of the mineral layers underneath.

In thickly wooded deciduous forest the degree of acidity of the layers of mineral soil is rather high. The P_H of the mineral soil is greater than that in the corresponding layers of humus.

(2) In woods thinly covered with evergreen trees the humus or the upper layers of the soil show less acidity than that of the corresponding strata in the thickly wooded forests of the same character in the same region.

(3) The humus or vegetal soil in the thinly covered forests of deciduous treed show less acidity than the corresponding beds in the thickly wooded forests of similar species. The mineral sub-soil of thinly covered coniferous woods has about the same degree of acidity as that of thickly wooded forests of non-deciduous trees.

The mineral subsoil of thinly covered forests of deciduous trees is less acid however than that of densely-covered forests of the same kind of trees.

(4) In cases of forests which consist partly of non-deciduous and partly of deciduous trees the humus soil always shows a P_H lower than the corresponding strata of purely coniferous woods. The degree of acidity of such soils is about the same as that of thinly covered coniferous forests or that of dense forests of deciduous trees. The mineral subsoil of mixed forests (non-deciduous and deciduous trees) had less acidity than the humous soil that covers it. The latter is also less acid than the humous strata of purely acicular forest and sometimes has a lower degree of acidity than forests consisting only of deciduous trees.

(5) The lower degree of acidity of the humous and mineral soils when conifers are mingled with other types offers more favourable conditions to the micro-organisms of the forest. For this reason the biological process of mineralisation proceeds more easily in the soils of mixed forests.

(6) The degree of acidity of the layers of soil vary continuously during the year, in this respect, that the P_H is higher in the autumn than in the spring.

(7) The catalytical power depends on the presence of organic matter. The intensity of this reaction has a certain relation to the degree of acidity as well as to the number of micro-organisms in the soil.

L. SMOLÍK.

Application and Significance of Electrometric Titration for the Determination of the Reaction of Soils.

NIKLAS, H. and HOCK, A. Anwendung und Bedeuting der elektrometrischen Titration bei der Reaktionsbestimmung unserer Böden. *Zeitschrift für angew. Chemie*, XXXVIII, 195. 1925.

To judge of the soil reaction, the actual acidity (hydrogen-ion concentration) as well as the potential acidity (total or titration acidity) must be determined. This latter is established, as is well known, by titration on the DAIKUKARA method or one of its modifications, while the former is ascertained by the electrometric or colorimetric method. For an exact study of the soil reaction, next to determination of the sizes of the soil fractions, knowledge of the buffer action is important. The azotobacter method gives an approximate idea of the content of the soil in buffer-action, such method being the biochemical expression of the buffer-action of the soil, which is measured with precision by means of electrometric titration. This process is carried out in the following way : the soil reaction is ascertained by means of an electrometer, and the modification of the existing acidity controlled by adding exactly known quantities of acids or alkalis, after which the added quantities of acids or alkalis are marked on the abscissae and the corresponding values for P_H on the ordinates of a graph and the respective titration curves drawn. If a soil with exchangeable acid is agitated with potassium chloride, there is formed, as is to be expected according to KAPPEN, aluminium chloride, which gives with electrometric titration a typical series of curves. The majority of the acid mineral soils gave, on electrometric titration of their potassium chloride extracts, curves which indicate the presence of aluminium chloride and consequently exchange acidity, while forest soils show a completely different series of curves, because in their case the acidity is caused by humic acid and phosphatic acids. To carry out the electrometric titration, 50 gm. of soil are agitated with 125 gm. of 7.5 % KCl solution for half an hour: after decantation has been effected 10-20 cc. (of the solution) are pipetted, and this treatment is repeated. The authors recommend the use of the universal indicator prepared by themselves, with a view to establishsing an important point, viz. how much alkali should be added, so as not to cause too great divergences in the curve. If the turbid decantation residue is used, the electrometric titration becomes more difficult ; with sandy and light soils it is still practicable, but with heavy clays and loams it becomes quite impossible on account of the fouling of the electrodes by the soil colloids.

K. SCHARRER

Electrometric Filtration and the use of Quinhydrone.

NIKLAS, H. and HOCK, A. Die elektrometrische Titration unter Verwendung von Chinhydron. *Zeitschrift für angewandte Chemie*, XXXVIII, 407. 1925.

The investigations of the authors showed that the quinhydrone electrode may be successfully employed up to P_H 8 for determination of soil reactions.

The values found are useful and in conformity with those obtained by the use of the hydrogene electrode. The quinhydrone-electrode may also be used successfully in electrometric titration. K. SCHARRER

Studies on Base Exchange in Rothamsted Soils.

PAGE, H. J. AND WILLIAMS, W. *Trans. Faraday Society*, XX, 573, 1925.

The Rothamsted soils which have been manured in the same way since 1843 (Broadbalk) and 1856 (Park Grass) show in an accentuated form the effects of basic exchange.

On Broadbalk where potash has been supplied, exchangeable potash is higher than on plots receiving no potash. Values for exchangeable Mg are smaller, for Na and NH_4 very little. After accounting for K removed by crops and drainage the exchangeable K, in soils receiving K exceeds the exchangeable K in soils not receiving K by only a fraction of the amount known to have been supplied. There is reason for supposing that this potassium can change into a non-exchangeable form.

The soils in question contain about 3 % chalk. Considering the ratio of exchangeable Ca, Mg and K to total exchangeable base, Ca is highest and has maximum value in soils receiving no manure or only NH_4 salts and Na salts. Next in order come soils receiving K and lowest are those receiving Mg. Farmyard manure increases amounts of total exchangeable base. Variation of absorption capacity is due to two factors.

(I) Total exchangeable base increases with increase in quantity of clay and fine silt II.

(II) Organic matter is approximately twice as effective an absorptive agent as clay and fine silt II.

On Park Grass soils the effect of liming on the quantity of exchangeable base is very marked. Exchangeable Ca increases with increasing P_H. Saturation for Ca is reached at a point where 1 % of chalk is added to a mixture of soil from the limed and unlimed portion of a plot receiving complete artificials. The HISSINK method of determining exchangeable base is not suitable for soils containing chalk, because of the absorbed H ions in the presence of NaCl solution. The difference between the basic exchange definition of " Saturation " and RAMANN's definition is discussed. T. E.

Base Exchange in Relation to the Problem of Soil Acidity.

ROBINSON, G. W. and WILLIAMS, R. *Trans. Faraday Society*, XX, 586, 1925.

Lime requirement is a conventional determination with no constant correlation with practice. Acidity is due to the presence in the soil of complex alumino-silicic acids, humic acids and their salts. According to the degree of acidity or desaturation with respect to base, the free acid rather than the salt phase preponderates.

Most lime requirement methods measure degree of desaturation

On some Welsh soils devoid of $CaCO_3$, a high degree of unsaturation for Ca is accompanied by fertility and unresponsiveness to lime. All such soils show considerable amounts of exchangeable Ca by the HISSINK method.

Soils responding to lime show very small exchangeable Ca content. Response to lime is a function of actual exchangeable Ca rather than a saturation deficit. Exchangeable Ca is approximately proportional to Ca availability when the latter is measured by extraction of Ca by dilute CO_2 solutions. This generalisation only applies to the soils of low clay content and high exchangeable Ca content. The distribution of soils in Wales shows those of low exchangeable Ca to be upland soils subject to severe leaching and those with high exchangeable Ca content to be the valley soils. T. E.

The Relation between the P_H Value, the Lime Requirement, and the Thiocyanate Colour of Soils.

SAINT, S. I. *Trans. Faraday Society*, XX, 594, 1925.

Comparable data for a series of soils are given for: (I) P_H measurements by the quinhydrone electrode, (II) HUTCHINSON and MACLENNAN lime requirements, (III) a standardised thiocyanate determinaition. A general connection between the three is displayed. The correlation improves if the soils are divided into a light and a heavy group. The heavy soils give greater absorbing surface and absorb more base in lime requirement determination, but do not necessarily give correspondingly darker thiocyanate colour. Organic matter increases lime requirements without corresponding increase in thiocyanate colour. Colour is influenced by the amount of iron present.

Data are given for similar light soils with different thiocyanate colour but same P_H lime requirement and titrateable acidity in thiocyanate extract, and for a light and heavy soil with differing colour and P_H values but same lime requirement and titrateable acidity in the extract. T. E.

Cause and Nature of the Transformation of Lime in the Soil.

SCHEFFER FRITZ. Über die Art der Umwandlung des Ätzkalkes im Boden und ihre Ursachen. Inaugural Speech at Göttingen. 1925.

The author shows by his analytical experiments, that the transformation of CaO into $CaCO_3$ does not take place quantitatively but that a part of the CaO enters into other combinations. The quantity of CaO that does not change into $CaCO_3$ depends upon the various absorbing chemical agents that are found in the different soils. The principal absorbing agents are silicic acid gel and the gel mixture SiO_2-Al_2O_3. The combination of CaO and SiO_2 gel are facilitated also by the $CaCO_3$ which is already decomposed. The above experiments tend to correct the results obtained by LOHMANN on the same subject. HELLMERS

Quantity and Nature of the "Black Substance" in certain Moravian Soils.

SMOLÍK, L. *Zemědělsky Archiv.* Prague, 1924.

The author has made use of the American method for the determination of the "black substance" (washing the soil with 1 % HCl and extraction with 3 % NH_3. The results lead to the following conclusions:

(1) The content of the black substance varies in the soils of Moravia from 0.718 to 2.598 % in the cultivable soil and from 0.211 to 2.75 % in the subsoil.

(2) In the cross section the black substance generally increases at lower levels until it reaches a maximum after which it diminishes rapidly. It may therefore be the case that the subsoil contains a larger quantity of the black substance than the cultivable soil above.

(3) The colour of the black substance in the above mentioned section is darkest in the layer of cultivable soil and gets lighter and lighter as the depth increases and becomes finally light yellow. The soil sections of more arid climates show exceptions to this rule. In these the lightest colour was to be found immediately under the upper layer of soil. The colour of the black substance from the limy cultivable soil of more arid climates was darker than that of similar soils from regions with a wetter climate.

(4) The amount of humus varies from 12 to 67.8% of the total of humus soil.

(5) The quantity of these substances also increases to a certain depth after which it decreases. In this respect the maximum of black substance does not correspond however to the maximum of the humus material in the soils.

AUTHOR.

Soil Biology.

Soil Analysis by Means of Bacteria.

CHOUCHACK, D. Analyse du sol par les bactéries. *Comptes rendus Académie des Sciences*, No. 22, pp. 1842-1844. Paris, 1924.

The author has made use of the catalytical action of soil bacteria on water saturated with oxygen. This action is due to the organisms and also to the mineral substance in the soil.

In order to determine the part that these mineral substances have in the catalytical action, the reaction is examined before and after boiling, which kills the bacteria.

By adding nitrogen, phosphoric acid, potassium, alone or in combination, the catalytic decomposition of the water saturated with oxygen makes it possible to ascertain which is the element present in the minimum proportion, which knowledge can be used in subsequent experiments.

PIERRE LARUE.

Partial Sterilisation of Soil by Antiseptics.

MATHEWS, ANNIE, *Journ. Agr. Science*, XIV, pp. 1-57. 1924.

"Quantitative determinations have been made of the effect on soil protozoa and bacteria of various antiseptic substances, including benzene and its homologues and derivatives, carbon disulphide, formaldehyde, and chloropicrin. It was found that nearly all of the substances disappeared from the soil fairly quickly, and at the same time bacterial numbers fluctuated... the process was much slower in field soil than in the richer greenhouse soils.

The increase of the bacteria during the early days varied in the same direction as the molecular weights and heats of combustion of the antiseptics, and is attributed to the latter property".

The author concludes that the rise in the number of bacteria is largely due to the bacteria feeding on the antiseptic.

In an appendix are given tables showing relative stability and the amounts of the various compounds found to be effective in inhibiting or destroying protozoa, eelworm (*Heterodera*) and fungi, in relation to their effect on bacterial numbers.

P. H. H. GRAY.

Preliminary Investigations on the Relationship of Protozoa to Soil Fertility with Special Reference to Nitrogen Fixation.

NASIR, S. M. *Annals of Applied Biology*, Year X, pp. 122-133, 1923.

In artificial culture media, and in sand cultures, with mannitol, more nitrogen was fixed by free N—fixing bacteria in the presence of protozoa than in their absence. The percentage gain over nitrogen fixed by bacteria alone varied from 8 % to 28 % in artificial media with different species of protozoa or mixed faunas, and reached the following figures in sand cultures.

	Maximum figures of N. fixed % gain over bacteria alone.
Bacteria with Ciliates	36
» » Amoebae	25
» » » and Ciliates. . . .	19.4
» » » and Flagellates .	2.7

Out of 36 experiments made in duplicate or triplicate, 31 showed a positive gain.

P. H. H. GRAY.

Protozoa from the Soils and Mosses of Spitzbergen.

SANDON, H. *Journ. Linnean Soc. Zoology*, XXXV, pp. 474-475. 1924.

Three samples of mud, 8 of soils, and 15 samples of mosses, collected by the Oxford University Expedition to Spitzbergen, 1921 and 1922, were examined qualitatively for Protozoa, which were found to consist of types generally met with in temperate soils. The severity of climate

appears to result not in the occurrence of local species, but in elimination of the less adaptable forms. Many forms found in tropical soils are identical with some occurring in Spitzbergen.

P. H. H. GRAY.

Soils and Vegetation.

The Forestery Value of the Sands of the Dunes and of Sandy Soils in General.

ALBERT, Der waldbauliche Wert der Dünensande, sowie der Sandböden im allgemeinen. *Zeitschrift für Forst- und Jagdwesen*, Year, XLII, pp. [illegible] (from the Laboratory for Soil Science of the Forestry School of Eberswalde).

The usefulness of the method adopted by ATTERBERG for the valuation of sandy soils has already been indicated in an earlier publication by the same author, in which he wrote upon the deep diluvial sands of the forests of Lieberosen (*Zeitschrift für Forst- und Jagdwesen*, Jahrg. 56, p. 193).

In the present article, the author examines particularly sand from the Dunes of the State Prussian Forests of Bienenthal by the use of the ATTERBERG method. It was surprising to find that these sands were not nearly so regular in respect to the size of their grains as had hitherto been supposed. The detailed table in his article shows, that not only the single sandy soils, but also the various layers of each cross section have grains of different size. Coarse sand (over 0.2 mm.) is found at a rate of 43 to 97 %. ATTERBERG states that sand must not be under 0.2 mm. in order to allow water to pass through. This condition is of course very important for the fertility of the soil. In other words the natural value of sand depends upon the percentage proportion of the constituents of soil that consist of particles of a diameter over 0.2 mm., and those parts consisting of smaller particles.

It is therefore possible to divide the sands of the Dunes within the same region into 5 types taking as a bassis the percentage of fine sand in each group for each type (under 10 %, 15 %, 20 %, etc.). These types of sandy soils are characterized by definite flora which is significant for each type. For instance, soils of the IVth type (30 % of fine sand) support rbeech trees and pines in about equal numbers.

GROSSKOPF.

23 The Influence of the Amount of Nutritive Substances and of the Soil Acidity on the Growth of Trees in the Flottlehmgebieten of Syke in North-West Germany.

GANSSEN R., and GOERZ G. Der Einfluss des Nährstoffgehaltes und der Azidität des Bodens auf das Wachstum der Holzarten im nordwestdeutschen Flottlehmgebiet von Syke. *Second provisional report of the Laboratory of the Prussian Geological Institute*, Vol. 5. Berlin 1925.

In connection with the results of the chemical investigations carried out in the same region, the authors state that GOERZ by determining the relative conductibility obtained data that allow a valuation to be made of

the amount of soluble nutritive substances in the soil. Dr. LIESE of Eberswalde suggests the application at the same time of a method of investigating the conductibility of the sap by the use of a special electrode. This enables a valuation to be made of the different degrees of growth and shows the difference of growth in relation to the amount of nutritive substances soluble in water.

Numerous estimations have been grouped into a table, approved by a specialist in forestry which offers a means of valuation of the growth of the total forest. The table states besides the data for acidity of the soil, relative conductivity of the soil, relative conductivity of the sap, all of which factors have been classified in relation to the various timber species. The influence on the growth of the trees of the amount of nutritive substances soluble in water, is clearly seen in the data for conductivity of the soil and more so in those which determine the conductivity of the sap. It is also clear that the energy of growth of the tree, which is expressed as conductivity of the sap greatly depends upon its location. GOERZ.

Effect of Soil Alkali on Plant Growth.

HARRIS, F. S.

Results of over 18 000 determinations on the effect of alkali in the soil on the germination of seeds and the growth of plants were presented. From these data the following conclusions were drawn :

The effect of the various alkali salts in soils on plant growth and the quantity of alkali that must be present to injure crops, are of great practical importance to farmers in arid regions, as well as of considerable interest to the scientist.

Only about half as much alkali is required to prevent the growth of crops in sand as in loam.

Crops vary greatly in their relative resistance to alkali salts, but for the ordinary mixture of salts the following crops in the seedling stage would probably come in the order given, barley being the most resistant : Barley, oats, wheat, alfalfa, sugar beets, maize and Canada field peas.

Results obtained in culture solutions for the toxicity of alkali salts do not always hold when these salts are applied to the soil.

The percentage of germination of seeds, the quantity of dry matter produced, the height of plants, and the number of leaves per plant, are all affected by alkali salts in about the same ratio.

The period of germination of seeds is considerably lengthened by the presence of soluble salts in the soil.

The anion, or acid radical, and not the cation, or basic radical, determines the toxicity of alkali salts in the soil. Of the acid radicals used, chlorine was decidedly the most toxic, while sodium was the most toxic base.

The injurious action of alkali salts is not in all cases proportional to the osmotic pressure of the salts.

The toxicity of soluble salts in the soil was found to be in the following order : Sodium chloride, calcium chloride, potassium chloride,

sodium nitrate, magnesium chloride, potassium nitrate, magnesium nitrate, sodium carbonate, potassium carbonate, sodium sulphate, potassium sulphate and magnesium sulphate.

The antagonistic effect of combined salts was not so great in soils as in solution cultures.

The percentage of soil moisture influences the toxicity of alkali salts.

Salts added to the soil in the dry state do not have so great an effect as those added in solution.

Land containing more than about the following percentages of soluble salts are probably not suited, without reclamation, to produce ordinary crops. In loam, chlorides, 0.3 per cent. ; nitrates, 0.4 per cent. ; carbonates, 0.5 per cent. ; sulphates, above 1.0 per cent. In coarse sand, chlorides, 0.2 per cent. ; nitrates, 0.3 per cent. ; carbonates, 0.3 per cent., and sulphates 0.6 per cent. H.

The Cultivation of Corn, Weed Control and Moisture Conservation.

The Illinois Experiment Station Bulletin No. 259

The principal object and greatest value of corn maize cultivation on Brown Silt Loam is the destruction of weeds. Weedy corn probably suffers more from a lack of nutrients than from a moisture deficiency. The depth and frequency of the cultivation of corn should be determined by the weed growth.

Deep cultivation of corn may result in root injury and decreased yields in comparison with shallow cultivation. The effect of excessive and deep cultivation seems comparable to that of actual root pruning. Proper cultivation should kill the weeds with minimum injury to the corn roots.

The need for cultivation seems to be no greater in dry than in wet years ; it may, in fact, be less. However, on heavy soils which work badly, cultivation may be necessary in order to fill the large cracks and thus stop the direct loss of moisture from the deeper strata.

The data and brief discussions presented in this bulletin are intended to be of assistance in developing the principles underlying the successful cultivation of corn and are not intended as recommendations of specific methods or particular implements.

D. C. Wimmer and M. B. Harland.

Regional Soil Science.

The Nature of the Rocks and Soil of the Upper Layers of Soil in the Kursk District (Russia).

Afanassieff, Prof. J. N.

(1) The slightly irregular geological formation of the Kursk District is due to the fact that this elevated plateau, which belongs to the middle Russian hills, has been untouched by the Greater-Scandinavian Glacier

The redeeming feature of this District is the entire absence of moraine deposits.

(2) The original rocks that lie on the surface in the Northern part of the District (about as far as the river Sseim) form Cretaceous groups — marly wacke (Opoka, marl from which the chalk has been removed by silicic acid), marl, chalk.

The Southern half of the district is composed of sands of the Tertiary System and of clay soils of a loamy and sandy character belonging to the stratum of Poltawa-Charkow. The Post-Tertiary sands are also to be found occasionally in the Northern part of the District.

(3) Over a considerable surface of the territory in question the mother rocks are covered with a layer of deposits belonging to the IVth period. These layers have a maximum thickness of 12 metres and form the natural area for agriculture. They are composed of the following horizontal strata (from the surface down):

Fourth Period:

Stratum where the loess plateau is being denuded; surfaces which are being washed away along the slopes of the lowlands; deposits of the terrace slopes of the rivers.

Third Period (alluvial):

1. Loess, nutbrown loam to a depth of 2 metres.
2. Loess, sandy loam, dull yellow to a depth of 3 metres.
3. Loess-like sandy loam, chestnut brown.

Second Period (lake alluvial):

4. Inundated soil, marsh meadow soil.

4. A. Loess-like loam, yellow to dark-brown.

4. B. Sandy loams and clays sometimes loess-like, sometimes coarsely sandy, loamy sands and sands.

First Period (river glacial period).

5. S. Inundated, marshy meadow soil.

5. A. Dark brown loam with rubble and boulders from marl.

6. A. Rubble stones and residues of rocks of Cretaceous Period.

7. A. Cretaceous groups, marly wacke, marl and chalk.

5^{1}-B. Large sandstones.

5-B. Coarse sands with gravel and boulders of the mother rocks, rare crystal stones.

7-B. Formations of Tertiary System grey sands, and glaucous sands.

Note 1. The different kind of strata sub letter " A ", are regions where the deposits of the 4th period have a substratum of Cretaceous formations; those under letter " B " have a sub-soil of Tertiary formations.

Note 2. It has been possible to show that each period had 3 phases: (1) an accumulative phase in which the stones were deposited: (2) a stationary phase, in which upon these stones the ancient types of soil formed themselves, and (3) the erosion phase when the soils and stones were inundated.

These phases were demonstrated by characteristics of the middle strata of inundated soils and furthermore by the stones that form a limit betwen the two phases. These stones are frequently brought to the surface in the steep forests on the right side of the river and on the slopes in the south and the west of the country.

(4) With regard to the general topographical aspect of the Kursk District :

It is a region that is sharply divided by numerous gorges and indentations. These divisions are remarkable for their great age and depth, and the predominating feature of the surface in this district is steep slopes. The elevated embankments of the watersheds are generally circular ridges with a diameter of about 150 Fade (300 metres).

(5) An efficient drainage of the watersheds and of a great part of the slopes is required as otherwise the steep slopes would render the country unfit for agricultural purposes.

In different places at a low level, underground water-courses were formed which acted as a drainage system, and in consequence formed moist soils upon the slopes.

(6) The moisture and the rise to the surface of the original stones at certain points along the slopes, and their lateral developments, together with the level tracts along the rivers served in a primeval age as roads and as land suitable for the development of forests on the originally bare steppes of the Kursk district This perpetual struggle for existence between forests and steppes has caused the formation of the Kursk Forest steppe. These Forest steppes are a peculiar formation which covered in places the originally monolithic steppes, like a carpet with beautiful designs, in some places compact masses of forests, in others merely strips and groups of coppices.

(7) The upper stratum of earth which forms the soil in the district of Kursk is in accordance with the above described historical and natural conditions. In the whole region the "Black Earth" (Tschernosem) is predominant. This is the most ancient type of earth and is a product of the period of the formation of the steppe. As the forests covered the steppes the black earth suffered a degradation. The results of the various degrees of transformation of black earth under the pressure of the woods are the following types: (1) Degraded black earth as the first product of transformation; (2) forest soils in various degrees: (3) podsol soils.

(8) These 4 types of soils may be devided as follows in regard to the hydrographical formation of the region and its general topographical character: (1) The Northwestern part of the District forms a region where forest soils predominate with small areas of degraded black earth; (2) The Northeast and the East (as Southern limit the river Sseim) a complex of degraded and pure black earth with small areas of forest soils and finally, (3) the South and South-East of the District predominating normal black earth, with certain places showing degraded black earth and various forest-soils.

(9) In order to give a definition of each type of soil in regard to

the topography of each region the following scheme may be used: the river plains and slope soils are composed of dark coloured meadow lands, sandy terraces and plains that are not exposed to inundation and the edges of the slopes (those that are moist from the leaching of water) or the mother rocks that obtrude from the side slopes all form strips of podsol soils. Higher up and at a greater distance from the rocks, forest soils are found that gradually pass over into degraded black earth and this in turn merges into normal black earth.

In the case where woods cover the steppes near to the side slopes, or when the plateau has suffered a considerable depression, the division of the soil presents itself in the following manner: Very deep down the soil presents a very decomposed condition which gradually, in layers, merges into normal black earth as the surface is approached.

(10) Due to the breaking up of the loess plains into deep and large slopes the micro-relief of the Kursk district shows very few small depressions. In the lower areas of the watersheds there are moist meadow lands.

(11) For the same reason mentioned in the first part of (10), that is the breaking up of the loess plain into deep and long slopes, the marsh is not represented in this District, nor is the salty earth which is always found in connection with marshes on the watersheds and on the slopes.

In the South and the South-East of the District the dark coloured soils also contain salt soils which have deposits of carbonate on the surface. These soils therefore may be considered as a climatic and geological bounary.

(12) In this District the "Stolptschatye Solonzy" (Salt deposits in columnar layers) are not found. These lands are characteristic of East and South-Eastern European Russia as an accompanying phenomenon of the Black Earth complex. Only in the above-mentioned South-East and Southern corner of the District salt formations have been discovered. These "Stolptschatye Solonzy" have not been found in the District of Tschernigow, but in the Woronesch District they exist in great quantities.

This fact together with other characteristics causes the author to suppose that a climatic boundary passes through the District of Kursch. East of this boundary the characteristics of a continental climate greatly increase, in the form of recurring periods of great aridity. West of the boundary however the mildness and humidity of the climate increases and makes it more like our Western climate which is not subject to injurious periods of aridity.

THE AUTHOR.

The Soil of Russia and the Surrounding Regions.

GLINKA, K., S. 1-348. Moscow-Leningrad, 1923.

The book contains a detailed description of the soils of pre-war European and Asiatic Russia, from a morphological, geographical and topographical point of view. In the Preface the author describes the processes of soil formation and the various types of soil; he then proceeds to a de-

scription of the level zones of Russia (tundra-zone, forest-zone, steppe-zone and the zone of deserted steppes) with their climate, vegetation, original rocks and soils. The author gives a similar survey of the vertical soil-zones of the Krim, the Ural, the Caucasus, Altai and Turkestan. The last chapter treats of the ancient and fossil soils of Russia.

The author.

An Agronomical and Scientific Examination of the Soil in the Welwarn District.

JANOTA, R.: Agronomisch-bodenkundliche Untersuchung des Bezirks Welwarn. *Publikationen des Zentralkollegium des Landkulturrates f. d. Königreich Böhmen*, Vol. 8, map scale 1 : 25,000. Prague, 1923.

This soil research work was begun by Professor KOPECKY and finished by JANOTA. Prof. KOPECKY has described the work in Volume 4 of the same review. An area of 217 km² has been closely examined; 2550 mechanical, 780 physical and 520 chemical analyses have been carried out for this investigation.

The leading Bohemian soil science specialists have taken part in this excellent work, particularly Prof. KOPECKY, who initiated it, RITZNKA, R. JANOTA, etc. The volume contains 216 pages and describes the soil research work carried out in the laboratories of Czechoslovakia.

The introduction draws attention to the necessity for scientific soil research. A description is given of the methods hitherto adopted and an explanation of the map. In the third part the characteristics of the soil are described, the climate, geological conditions and the scientific conditions. The work closes with a chapter on the production and manuring of the various soils and a chapter on the necessity of marling light soils.

The detailed descriptions of each type of soil form the largest part of the book.

As in the case of KOPECKY's book (1908) this work is also full of valuable practical experiences in the field of soil science. This book should be read by those interested in the progress of this science in Czecholovakia.

L. SMOLÍK.

Chalk in Lettonia.

ROZENSTEINS S. and LANCMAINIS Z. (in Lettish with a short summary in German). 50 pages, 20 photographs, Riga, 1924.

The authors mention 80 places where chalk is found. Some of these places have been thoroughly studied; the percentage of tufa chalk was determined and chemical analyses were carried out.

The authors divide these deposits into 2 groups: 1) loose and grainy deposits; 2) hard stony deposits (tufa chalk). The last group has received special attention, because this kind of deposit can be useful for technical and building purposes. The microscopical structure has been studied and the technical characteristics of tufa chalk and photomicrographs have been taken.

Tufa chalk may be easily worked with saws and adzes while in humid condition, has a great resistance to weathering and is very adaptable for facades, statues and as building material in general.

From a point of view of chemical composition the samples examined represent a relatively pure $CaCO_3$ without $MgCO_3$; some samples show an addition of $CaSO_4$ and of $FeCO_3$.

Often the deposits of tufa chalk show remains of plants, leaves and shells.

The study of these deposits may therefore produce very interesting data for the study of the characteristic climate and the flora of the period after the glacial epoch.

The numerous deposits of chalk in Lettonia — (which are far more numerous than indicated in the above mentioned work) — are also of great importance for the chemical industries that require pure $CaCO_3$, and they are useful for the improvement of podsol soils.

L. FREY.

Agricultural Conditions in Palestine.

SAWYER, E. R. (Director of Agriculture). A Review of the Agricultural Situation in Palestine. Department of Agriculture and Fisheries, Palestine, 1923. (Price 10 Piastres).

This work contains statistical material in addition to a large number of scientific articles, and gives a summary of the agricultural situation of Palestine during the year 1922. A communication by Sir WILLIAM WILLCOX "Extracts from a Report on the Irrigation of Sania Lands in the Jordan Valleys" speaks very favorably of the possibilities of cultivation and irrigation in this district, which lies between the Lake of Tiberias and the Dead Sea. The soil appears to have plenty of phosphates and lime. Data are given respecting the total amount of soluble salts of 9 different soils that have been analysed.

In Part IV it is stated that about half a million hectares are already cultivated and another 300,000 hectares are ready for cultivation.

Twelve soil analyses are given, and concern principally soils of the plain, near the coast and the mountains of Judea. Some of these soils have been chosen in order to present typical examples of soils suitable for tobacco planting, wine, oranges, almonds and sugar cane. As is to be expected in a semi-arid region, these soils are generally poor in nitrogen and rich in soluble salts.

Most of the analyses were made by the State agricultural and chemical laboratory in addition to two analyses by M. VINIK, which have been already published in "Der Boden Palästina's" by BLANCKENHORN.

REIFENBERG.

The Soils in the Drina, Save and Morava Areas.

STEBUT Prof. ALEX. A. *Zemljista Drino-Savo-Moravske oblasti.* Published by the Ministry of Agriculture. Belgrade, 1924.

This work records the beginning of a systematic investigation of Serbian soils. The following is a summary of its contents: Introduction;

Part. I. Methods of investigation, processes of soil formation; climate and types of soils in Europe (1-26). — Part. II. Chapter 1st: The factors which have most influence on the formation of the soils in the D. S. M. region; climate, vegetation, deposits, original rocks (27-51). — Types of soil: Black earth called "smoniza" (smola means pitch) and its varieties; brown earth called "gajngatscha" (gaj means grove); podsols called "pepeljusche" and "bolowatsche"; pasture lands called Kumsatschka, (51-96). — Chemical and mechanical analysis of some of the types of soil (97-109).

III Part. The most important agricultural characteristics of the soil-types in the D.S.M. region; measures for their improvement (110-161). — Conclusion. (162-163). — Resumé of the text in French (164-180).

The work concludes with 6 photographic reproductions and an index.

A. SEIWERTH.

The Soils of Lettonia.

VITINS J. (J. WITYN) (printed in Lettish) 50 pages. Riga, 1922.

In a short study on soil formation the author describes the process as follows: (1) Transformation of the mineral substances and their translocation nearer to or farther from the surface. (2) Development of the humus layers and (3) Transformation of the physical qualities of the mother rock as a consequence of the change in the mineral substances. He points out the principal factors of soil formation and the most important and common mother rocks (morainic, loams and their products) The process of soil formation of heavy clay soils is described. These heavy clay soils represent about $^1/_3$ of the total territory of Lettonia and are to be found in all the different gradations of the podsol. The clays contain $CaCO_3$ at the depth of 60 to 70 cm., even when the upper layers are of a strongly podsol type. The heavy marly soils in Lettonia contain about 20 % of $CaCO_3$, which has been admixed with the clay during the glacial epoch by the Silurian limestones of Estland.

The author says that the degree of podsol depends upon the climatic conditions, principally the quantity of rainfall. The rainfall varies from 400 mm. (Bauske) to 680 mm. (Hasenpoth, Goldingen). In the region of Bausken above the morainic loam, layers of ground are found that in character resemble the Tschirnosem and Rendsimen soils. Generally the $CaCO_3$ is washed out to a depth of 50 to 60 cm. In the region af Hasenpoth and Goldingen are found typical Podsol soils, though the line of demarcation also in these soils lies at a depth of 50 to 70 cm

After studying the process of formation of the podsol soils in Lettonia, the author distinguishes 4 phases in that process

I[st] Phase: Development of an immense layer of humus (40 to 50 cm.); the washing out of the $CaCO_3$ only begins in this phase.

II[nd] Phase: The layer of humus being devoid of $CaCO_3$, the calcium ion absorbed by the humous and zeolitic parts of the soil are attacked by the washing out process. The soil contains bad physical qualities and is almost impermeable to water or roots. Few soils in this condition are found; they very quickly change into the next phase

The 3rd Phase shows the further washing out of the finer particles of the upper layer and its deposition into deeper layers. This is due to a greater dispersion of the soil particles. The nature of the soil in this phase is very marshy and its colour grey.

IVth Phase. The layer of humus becomes smaller, the bottom stratus becomes ashy grey and lies on a bed of thick loam; the reaction of the soil is strongly acid. The point of "demarcation" in this phase is from 50 to 70 cm. depth, therefore little water passes into the deeper strata.

The author points out in his conclusions that there is a connection between the degree of podsol of the soils and their fertility. The production of strongly podsol type soils is 2 to 5 times smaller than that of soils in the first or second phase.

The decrease of acidity of the podsol soils is of great importance for fertility. Soils that have been very acid and in which the acid condition has been decreased produce in the same measure as non-podsol type soils.

L. FREY.

Report on the Soil Survey of the Dialah Area (Right Bank).

WEBSTER, I. F. and VISWANATH, N. *Department of Agriculture Mesopotamia. Memoir No.* 2, 1921 (The Times Press. Bombay 1921). Price 1 R.

This report gives the results of soil researches in a district in which a reconstruction of the old irrigation works had been planned. The hihg percentage of salt in the soil is due to the water used for irrigation purposes. (The analysis of this water shows 70-100 parts per 100000 of soluble salts, of which 15 to 25 parts are NaCl).

Thirty three soils were mechanically analysed and subjected to a chemical analysis in respect to the principal salts and nutritive substances.

The authors came to the conclusion that if the proposed drainage system is carried out good results may be expected. REIFENBERG.

Alkali Soils in Iraq, a Preliminary Investigation.

WEBSTER J. F. *Department of Agriculture, Mesopotamia, Memoir No.* 1, 1921. Bombay, The Times Press, 1921. Price R. 1).

In Mesopotamia, as in nearly all arid or semi-arid lands, alkali or sandy soils are to be found. The author calls the vilayets of Bagdad and of Basrah arid, giving as his personal opinion however that it would be more correct to call them "extremely Mediterranean".

During the summer the temperature risis to about 120° F. in the shade, while the humidity during that period is about 38 %. Under these conditions it is evident that a complete desiccation of the soil takes place. In winter the temperature in Bagdad is 27.5° F. and the relative humidity is 80 %. In this season there is about 5 inches of rainfall.

The author considers it of the greatest importance to take measures to prevent the soil from becoming over saturated with salt and when this condition exists, where possible, to carry out improvements.

The salts that are principally found in these regions are sodium sulphate, sodium chloride, and sulphate and chloride of calcium and magnesium, while the so-called "Black Alkali," sodium carbonate, is not found.

It has proved to be impossible to wash away the salts by flooding and drainage; this method only drives the salts into the deeper levels of the soil, after which they return to the surface owing to capillary ascension.

Mesopotamia, which at one time was one of the most fertile countries, is in danger of becoming a desert, this condition being due to the fact that the ancient methods of drainage have been forgotten.

According to the author the only solution is in drainage by percolation, by which the salts are finally conducted into the principal drainage system of the country. This system could only be applied by the Government.

The appendix of the work contains a number of analyses, illustrating the percentage of salts and their probable compounds. The map shows the division of the Dialah District into different salt areas.

REIFENBERG.

Further Studies on Alkali-Soils in Iraq.

WEBSTER, J. F. and VISWARATH, B. *Department of Agriculture, Iraq, Mémoir No.* 5, 1921 (The Times Press, Bombay 1921). Price Rs. 2.

In the first part of this book a study is made of the influence of soluble salts on the phyisical condition of the soil. The work was carried out as follows: A sample of soil was continuously washed until it was practically free of salts. At the same time the original soil was examined. Besides making a mechanical analysis, the authors studied capillary attraction, permeability, the absorption of salt solutions, hydroscopic power, pore space, degree of acidity and evaporation capacity of the soil.

In the second, part the influence of salts on saplings is demonstrated as well as the growth of young trees in naturally sandy soils. One experiment concerns the growth of saplings in soils with a variable percentage of salts but, with a constant percentage of nutritive substances. Another experiment investigates the maximum content of salts in a soil intended for wheat cultivation.

Further experiments are made on osmotic pressure and toxic influences. The investigation finally deals with sodium carbonate and the toxic effect of other soluble salts.

In Part III the authors discuss some conclusions drawn from their experiments.

Though many of the results of these experiments are not new, the work is very interesting. It is to be regretted that colloid chemistry in connection with the problem has not been treated.

REIFENBERG.

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General Information.

International Society of Soil Science. — The number of members of the International Society of Soil Science has very considerably increased n the last six months, so that the total is now 533. The list of members will appear in the next number of the Review.

Our Society has sustained the loss of one of its leading members in Professor MURGOCI, of Bucharest. The death of our friend and colleague, is a loss which is deeply regretted, not only for our Society and for the science of pedology, but also on personal grounds. MURGOCI was among those of my colleagues, who from the earliest days, that is from the first Soil Science Conference in Budapest, in 1909, took a deep interest in the progress of the Science. An appreciation of his conspicuous services will appear elsewhere in this Review.

When in May 1924 I expressed my willingness, in response to repeated requests, to undertake the work of General Secretary and Treasurer in addition to the office of Acting President, I could not suppose that this post would entail so much work. In future it will not be possible for me to devote so much time to the business of the Society. A part of the work must be undertaken by the National Sections, which in accordance with paragraph 6 of the Rules of the Society may be formed in the separate countries. My own idea is that Treasurer and the Secretaries, of these national sections, will in future assist me by making themselves responsible for correspondence with members, the collection of annual subscriptions, records of changes of address and so on, reporting to me on these points and sending me the subscriptions in a single account.

I should therefore be glad if the members would work for the formation of National Sections and report to me on the composition of the executive committees. It may be mentioned that each National Section of more than 15 members has the right to be represented by one member on the General Committee. For the present I should like to ask, (1) that members will reply at once to my enquiries, whether made by letter or circular, (2) that the

annual subscriptions may be sent to me in Dutch florins either by Post Office Order or paid into the "Geldersche Credit Vereeniging", Groningen, (Holland) on account of the International Society of Soil Science.

D. J. HISSINK,
Acting First President and
General Secretary.

Groningen, June 26, 1925.

The International Commissions. — The lists of members sent to me by the chairmen contained a whole series of names of collaborators who ar not members of the Society. It is however obvious that only members of the Society can be members of a Commission, or a Section. On the other hand it should be a matter of concern to new members to attach themselves to one or more Commissions. By agreement with the chairmen of the Commissions, therefore, all members are asked to inform me which Commission or Commissions they intend to join (See Circular of May 1925). As you may already be aware, the first Soil Science Congress will be held in May 1927 in Washington, U. S. A. The American Organising Committee, which includes Mess[rs] LIPMAN, MARBUT, McCALL, will provide all preliminary information. The first duty of the Congress is to consider the recommendations of the International Commissions. The Chairmen of the Commissions are expected to forward these recommendations at the proper time, and to come to an understanding with the American Organisation Committee. I am always perfectly willing to act in an advisory capacity, but the Commissions must themselves regulate their activities and methods of organisation independently.

The second International Soil Science Commission has already decided to hold at Groningen in the spring of 1926, a meeting for the preliminary discussion of the questions of soil acidity and soil adsorption. A circular has been sent out by the Organising Committee to all members of the Society and also to a large number of non-members, who will probably become members. It may be mentioned that the expenses of this meeting will not be defrayed out of the funds of the Society.

The Third Commission (Chairman, Prof. STOKLASA) also proposes to meet this year in advance of the Congress. The Committee for the Soil Map of Europe met on 8 and 9 May in Berlin. Prof. STREMME was elected Chairman in place of Prof. MURGOCI. Prof. WOLFF, Secretary of this Commission, which is a Sub-Commission of the Fifth Commission (Chairman, Prof. MARBUT), will report in detail on the Berlin meeting.

D. J. HISSINK,
Acting First President
and General Secretary

Groningen, 26 June 1925.

Notice of May, 1925 — The foundation subscription for the year 1924 was fixed at 2 dollars.

The subscription for 1925 has been fixed at 6.50 Dutch florins. New

members who have not paid the foundation subscription of 2 dollars pay an entrance fee of 2.50 florins.

Institutions, societies, libraries, etc., are eligible for membership as well as individuals.

Members receive the journal, edited by Prof. F. SCHUCHT, Berlin, free of cost. The journal is printed at and despatched from the International Institute of Agriculture, Rome, and appears in French, German, English, Italian and Spanish. Members are asked :—

1. to forward to me before 15 July 1925 the subscription for 1925 of 6.50 florins, in the case of new members with the entrance fee of 2.50 Fl ;

2. to send with the subscription their exact address *type-written* or *in block capitals* ;

3. to inform me in which of the five languages they desire to receive the journal ;

4. to inform me which Commission or Commissions they intend to join ;

5. to state whether they wish to obtain the Proceedings of the Fourth International Soil Science Conference (Rome, May 1924) at the reduced price of 80 French francs, the ordinary selling price being 100 francs. Members of the Rome Conference naturally receive the Proceedings free of cost.

The attention of members is called to the fact that it is absolutely essential to reply to these five queries at latest by 15 June 1925.

Dr. D. J. HISSINK,
Acting First President and General Secretary
Groningen (Holland), Hermand Colleniusstraat 25

II. **International Commission for the Study of Soil Chemistry.** — To the members of the International Society for Soil Science.

At the meetings of the Commission for the Study of Soil Chemistry held during the Fourth International Soil Science Conference (Rome, May 1925) the following questions received special attention: — soil acidity, soil adsorption (exchangeable bases, point of saturation, etc.).

The conduct of the further study of these questions was entrusted to Dr. H. R. CHRISTENSEN and Dr. D. J. HISSINK.

A detailed preliminary discussion of these questions in a meeting of the second Commission seems to be desirable in preparation for the First Soil Science Congress which is to be held in America in May 1927. With this object the undersigned have formed themselves into a preliminary Committee and have decided to hold this meeting of the second Commission in the spring of 1926, either April or May, in Groningen. The Committee is making the following arrangements for the meeting :—

Members of the Society who are specially interested in the above questions are asked to communicate their views in connection with particular subjects in as brief a form as possible at latest by 1 November 1925 to Dr. D. J. HISSINK. The papers should be forwarded in duplicate and typed in German, English or French. It is intended to print papers in the order in which they are received. The meeting in Groningen will be given up to the discussion of these papers.

In addition members are asked to state at the same time, or at latest by 1 November 1925, whether they intend to take part in the meeting at Groningen in the spring of 1926 and what date would suit them best, either the beginning of April (the Easter holidays) or the second half of April, or the begining or end of May. It is of course understood that this communication is only preliminary and that a final decision will be asked for only at the beginning of 1926.

Although it is mainly those members who are interested in the study of Soil Physics and Chemistry who will take part in the preparation for the meeting and in the discussions, it has been considered best to send this circular to the 500 members of our Society and moreover to our collaborators, who are not yet members but who may become so. We hope that this may prove an incentive to join. It may be remarked that only members of the Society have the right to send papers and to take part in the meeting.

Budapest (Hungary), Leeds (England), Lyngby (Denmark), Groningen (Holland), May 1925.

Prof. ALEXIUS A. J. von 'SIGMOND, Budapest.
Prof. N. M. COMBER, Leeds.
Dr. H. R. CHRISTENSEN, Lyngby.
Dr. D. J. HISSINK, Groningen, Holland, Herman Colleniusstraat, 25.

Report of a Meeting of the Supervisory Committee for the International Soil Map of Europe on 8 and 1o May 1925 in Berlin.

The Supervisory Committee for the International Soil Map of Europe, a section of the Fifth Commission of the International Society of Soil Science, deeply regrets the death of its Chairman, Prof. MURGOCI, which took place on 5 March and cut short a life of remarkable activity and success. As a consequence of this event and in view of the necessity for carrying out the preliminary work for the Soil Map on a uniform plan and with due regard to the experience gained and the proposals made since the Rome Conference, the Secretary found it necessary to invite members, as well as other foreign experts in the subject, to a conference, as had already been suggested at the Rome meeting. As is always the case with international conferences, only a certain number of those invited could undertake the journey. There were present: Prof. STREMME, Danzig; Dr. TAMM, Stockholm; Prof. von MIKLASZEWCKI, Warsaw; Prof. TREITZ, Chief Geologist, Budapest and Prof. WOLFF, Berlin.

The first business of the Committee was to elect a chairman, who might be expected to render active support to the work in such a way as to command the confidence of all experts. On the written proposal of Dr. FROSTERUS of Helsingfors Dr. STREMME of Danzig was elected. The Committee then filled the vacancy in its numbers by electing Prof. A. TILL in Vienna, in whose company the late Prof. MURGOCI had worked out his schemes. Among the other formal decisions may be mentioned one urging that the active co-operation of the European Geological Institutes that have not so far taken part in this work should be invited, and that the International Society of Soil Science should be requested to make a contribution of 100 marks towards

the Committee's expenses in this connection, which will be later reimbursed out of the receipts from the sale of the outline map of the Soil Map of Europe. Finally on the invitation of P. TREITZ it was decided to hold a meeting in the latter part of July (1926) in Budapest, so that the local soil conditions may be inspected together with the sketch map of the Hungarian soils that has already been prepared, and that suggestions may in consequence be made with a view to ensuring a right conception of the scheme and the proper presentation of the material in other countries.

The adoption of the lines suggested by Prof. MURGOCI and the continuation of the work on the map was recommended. The difficult conditions, especially the want of recognition of pedological research in most of the countries within the sphere of operations of the Committee, make it advisable that there should appear in the first place a sketch map on the scale of 1 : 10 million, which should show only the outstanding features of the nature of the soils. The map is to represent: by hatched lines, the sandy gravels and the clay loams, and also peat and rock: by three shades of green, the types of soil which are distinguished by excess of sesquioxides (Podsol types according to the degree of saturation; coloured violet in two shades, the types of soils which have only the upper mould (the A horizon) stained with humus (Tschernosem type) but not the B horizon with the excess of sesquioxides. As a working map the black print of the International Geological Map of Europe (1 : 1,5000,00) is recommended. The main principles of the map with the scale of 1 : 2,500,000 should first be definitely established, even if certain countries have prepared their maps on the scale of 1 : 10,000,000 as may very well be the case up to the Budapest conference in the summer of 1926. An estimate of the cost of maps with scales of 1 : 10,000,000 and 1 : 2,500,000 may be obtained from any cartographical institute, so as to give the committee and idea of the possibility of publication and the general style of the map.

W. WOLFF, *Secretary*,
Berlin, No. 4 Invalidenstr. 44.

Journal "Pédologie". — The readers of the above mentioned paper are informed that the Journal "*Pédologie*" appears once more under the Direction of Prof. JARILOW (Moscow). This Journal deals principally with publications in the field of soil science in Russia, and contains articles and reports. The journal is published in the Russian language and in a foreign language. The subscription for the year 1925 is 6 roubles; please apply to "User", Moskau, Smolensky, Bulw. 57, Committee for Soil Science, Office of the authorized representatives of the specialists in soil science of Russia.

Personal. — Hofrat (Court Councillor) Prof. Dr. Ing. agr. JULIUS STOKLASA, Professor at the Technical High School, Prague, known both as a scientist and as a man of pratical experience, celebrates the 50th anniversary of his scientific career. At the same time he has been for a quarter of a century Director of the chemical physiological experimental Station of Prague.

Professor STOKLASA has published a great many works some of which are already considered as standard works, for instance *Der biochemische Kreislauf der Phosphations im Boden* (the biochemical series of recurrent changes of phosphates in the soil) and another called *Über die Verbreitung des Aluminiums in der Natur.* (The distribution of Aluminium in nature), etc.

Dr. STOKLASA is also well known for his studies on the biogenetic elements in the plant organism, mainly phosphorus, sulphur, iodine, potassium, and aluminium, and for his work on the biochemistry of soil. Besides this he has done some very valuable work in the field of biology and his work has been of great use to soil science.

STOKLASA is the promotor of the International Commission for Soil Biochemistry and Soil Bacteriology. As President of this Commission he has taken part in several International Congresses. His knowledge and personality have ensured him a large following of friends in his own country as well as abroad. NIKLAS.

Forest officer Dr. KRAUSS, assistant at the Experimental Station of Forestry at Munich, has been appointed "Privat-Dozent" for soil science and agricultural forestry and chemistry at the University of Munich.

Professor RAMANN, Munich, was elected foreign member of the Hungarian Academy of Science and Professor A. A. J. von 'SIGMOND, hitherto a foreign corresponding member was elected an ordinary member of the same Academy.

Professor Ing. Dr. ADOLF SEIWERTH, lecturer of the Agricultural and Forestry Department of the University of Zagreb (Jugoslavia) was appointed Professor of Soil Science at that same University.

Professor SEIWERTH has been made President of the Institute of Agricultural Chemistry at Osyek.

We expect to receive an obituary notice of MURGOCI from Prof. POTOPOPESKU-PAKE.

Dr. FRIEDRICH KATZER, member of the Commission on Mapping of Soils, Director of the National Geological Institute, died in Sarajevo on the evening of 3 February 1925 at the age of 64.

Dr. KATZER was born on 5 June 1861 in Rokycany (Bohemia). After passing through the intermediate school in Prague, he devoted himself to the study of natural science, especially geology and chemistry at the University and technical higher school of Prague. After his career as a student he acted as assistant teacher of mineralogy and geology in the Prague technical school, In 1887 he gave up this post so as to specialize in the study of geology in Breslau, Berlin, Tubingen, Marburg and Giessen. In Giessen he obtained the doctorate in philosophy in 1890. He then did some temporary work at the Prague Analytical Laboratory, and subsequently in 1892 at the Institute of Mines at Leoben. After three years of active work in Brazil, he returned to Europe and took service under the provincial government of Bosnia and Herzegovina in the capacity of State geologist, from that time devoting his

life and his work to those countries. The results of his scientific labours are embodied in more than 140 articles in scientific journals. Among the most important of these may be mentioned the following: *Geologische Karte Bosniens und d. Herzegowina; Geologischer Fuhrer durch Bosnien u. d. Herzegowina; Fahlerze u. Quecksolberlagerstätten Bosniens u. d. Herzegowina; Die Braunkohlenablagerungen Bosniens u. d. Herzegowina; Die Eisenlagerstätten Bosniens u. d. Herzegowina; Karst und Karsthydrographie.* KATZER did not live to see the accomplishment of his last monumental work "*Die Geologie Bosniens*" in 4 volumes, the publication of which has been begun by the Mining Section of the Bosnian Government, only the first volume having up to now appeared in German. F. KATZER received a number of decorations. He was also honorary member of several scientific societies and was elected in the year before his death member of the Belgrade Academy of Science. Quite recently the appreciation by the authorities of his scientific and official activities took the form of recognition by the conferring of the Royal Order of St. Sava. By his death a serious gap in the ranks of the scientific circles of Yugoslavia has been occasioned. But although removed by death, his work will endure and Yugoslavia together with Bosnia and Herzegovina will honour his memory.

A. SEIWERTH.

SPECIAL ACTIVITIES
OF THE BUREAU OF AGRICULTURAL SCIENCE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

INTERNATIONAL COMMISSION OF AGRICULTURAL METEOROLOGY.

INTERNATIONAL INSTITUTE OF AGRICULTURAL ECOLOGY (1).

An International Institute of Agricultural Ecology has been founded at Rome under the auspices of the Royal National Academy. At the inaugural meeting held on the 1st June, 1923 in the presence of H. M. the King of Italy, the President of the Academy spoke in praise of our initiative and expressed himself in the following terms:

"The Institute of Agricultural Ecology, which was founded under the auspices of our Academy with the object of co-ordinating and directing the work and researches on the growth and yield of crops all over the world, has continued its work, and to-day, thanks to the support it has received from all quarters, it has proceeded to the definite formation of an International Commission of Agricultural Ecology, also under the aegis of the Academy. This Commission will begin active work, as to the utility and importance of which it is unnecessary to insist" (*Atti Accademia*).

The Commission at present is formed of the following members, of whom the number will be gradually increased as the new research work develops and penetrates into the agricultural circles of the different countries.

(1) Report of the President of the International Permanent Commission on Agricultural Meteorology to the Permanent Committee of the International Institute of Agriculture and published by the order of the same.

INTERNATIONAL COMMISSION OF AGRICULTURAL ECOLOGY.

Argentina : Dr. C. BREBBIA, Delegate of Argentina at the International Institute of Agriculture.

Australia : Prof. GRIFFITH TAYLOR, Professor of Geography at the University of Sydney.

Belgium : Prof. F. SMEYERS, Professor at the Higher School of Agriculture at Ghent (Belgium) ; P. DE VUYST, General Director of Agriculture, Ministry of Agriculture, Brussels ; J. VAN DER VAEREN, Inspector General, Chief of the Cabinet of the Belgian Ministry of Agriculture and Public Works, Brussels.

Brazil : Hon. DEOCLECIO DE CAMPOS, Delegate of the United States of Brazil at the International Institute of Agriculture.

Bulgaria : Prof. H. E. MOLLOFF JANKO, Minister of Agriculture and Professor of Economics at the University of Sofia.

Canada : L. W. NEWMAN, Dominion Cerealist, Central Experimental Farm, Ottawa (Canada).

Czecho-Slovakia : V. NOVÁK, Chief of the Pedological Institute, Brno.

Denmark : Prof. E. LINHARD, Professor at the Higher School of Agriculture, Copenhagen.

Dutch Indies : C. OPOLSKI, Wanasoeka, Pengalengan (Java).

Egypt : C. B. WILLIAMS, Entomological Section, Ministry of Agriculture, Cairo.

France : G. WERY, Directeur de l'Institut National agronomique, Paris ; A. PRUDHOMME, Directeur de l'Institut National d'Agronomie coloniale, Nogent-sur-Marne ; A. CHEVALIER, Directeur du Laboratoire d'Agronomie coloniale, Paris.

Germany : Prof. Dr. P. HOLDEFLEISS, Professor of Agricultural Meteorology, University of Halle.

Great Britain : Sir JOHN RUSSELL, D. Sc., F. R. S., Director of the Rothamsted, Experimental Station, Harpenden ; B. A. KEEN, D. Sc., F. Inst. P., Assistant Director, Rothamsted ; C. A. BARBER, C. I. E., D. Sc., Professor of Tropical Agriculture, University of Cambridge ; W. S. GRAY, B. Sc., A. I. C., International Institute of Agriculture, Rome ; Prof. J. PERCIVAL M. A., F. L. S., Professor of Agricultural Botany, University College, Reading.

Great Lebanon : HAIDAR, Directeur de l'agriculture de l'Etat du Grand-Liban, Beyrouth (Syria).

Greece : T. ISAAKIDES, Director of Phytopathology, Ministry of Agriculture, Athens.

Holland : Dr. D. VAN GULIK, Higher School of Agriculture, Wageningen.

Indo-China : P. CARTON, Chef du Bureau des Renseignements agricoles à la Direction des Services Economiques de l'Indochine ; DU PASQUIER, Directeur de la Station expérimentale d'agriculture, à Phu-Tho, Tonkin ; The Governor General of Indo-China has appointed an officially Corresponding Commission, with the Directeur des Services Economiques as Chairman and composed of the following Members : (1) Le Directeur de l'Observatoire Central

Météorologique de l'Indochine ; (2) Le Chef du Service général de l'Agriculture ; (3) Le Chef du Bureau des Renseignements agricoles.

Italy : Prof. R. PIROTTA (*President*), Director of the Botanical Institute of the University of Rome ; President of the International Permanent Commission on Agricultural Meteorology at the International Institute of Agriculture (Rome) ; Prof. G. AZZI (*Secretary*), Prof. of Agricultural Ecology at the Higher School of Agriculture, Perugia and Director of the Department of Agricultural Meteorology ; Dr. A. BRIZI, Director General of Agriculture, Ministry of National Economy (Rome) ; Prof. L. PALAZZO, Director of the Central Bureau of Meteorology and Geodynamics (Rome) ; Conte EDOARDO SOLFERINI, Senator (Rome) ; Prof. O. MUNERATI, Director of the Experiment Station for Beet Cultivation (Rovigo).

Japan : Dr. H. ANDO, Director of the Imperial Agricultural Experiment Station, Nishigahara (Tokyo).

Kingdom of the Serbs, Croats and Slovens : MIRKO KORICH, Director of the Agricultural Experiment Station, Krizevchi (Croatia) ; V. V. GEORGIEVICH, Director of the Union of Rural Cooperative Societies of Pozarevac (Serbia).

Luxemburg : Dr. ZANEN, Ministry of Agriculture.

New Zealand : D. E. WARD, Instructor in Agriculture, Department of Agriculture (Christchurch).

Norway : Dr. ANDERS FJELSTAD, Delegate of Norway at the International Institute of Agriculture (Rome).

Portugal : Prof. FELIPE DE ALMEIDA FIGUEREIDO, Instituto Superior de agronomia, Cadeira de Fisica agricola, Lisboa (Lisbon).

Roumania : JONESCU SISESTI, Director General of Agriculture (Bucarest).

Russia : Prof. P. I. BROOUNOFF, Director of the Department of Agricultural Meteorology, Professor at the University of Leningrad ; Prof. VAVILOFF, Director of the National Institute of Genetics and Applied Botany (Leningrad) ; Prof. SCHEFLER, Collegiate Member, National Commissariat of Agriculture (Moscow).

Spain : THE COUNT OF MONTORNÉS, of the Royal Court of Spain.

Sweden : Prof. HJALMAR NILSSON, Director of the Experiment Station at Svalöf.

Switzerland : Dr. G. MARTINET, Chef de l'Etablissement Fédéral d'Essais et de contrôle de semences, at Lausanne.

Turkey : ALI RIZA, Director of the Higher School of Agriculture at Halkali (Costantinople).

United States of America : Prof. ASHER HOBSON, Delegate of the United States at the International Institute of Agriculture (Rome) ; Dr. J. G. LIPMAN, Director of the Agricultural Experiment Station, New Jersey ; F. CLEMENTS, Desert Laboratory Tuxon, Arizona.

The above have promised their active assistance and are not collaborators in name only, but will be of material assistance to the work of the Society. A large number have already contributed very interesting documents which will add to the success of our work.

A very good understanding may be established with the *International Institute of Agriculture* in the sense of the resolution adopted at the VII General Assembly. Further, the *Chair of Agricultural Ecology* founded at the *Higher Agronomic Institute of Perugia* by the Italian Government might well become a centre for the training of qualified technicians for the Ecological Stations of different countries.

The Executive Committee of the International Commission on Agricultural Ecology formed by the Members of the Commission present in Rome, at its meeting held on 12th February 1924, approved the following programme of work:

(1) The principles of Agricultural Ecology (Ecological unit);
(2) The Ecological Problem of Wheat;
(3) The International Network of Stations of Agricultural Ecology.

I.

THE PRINCIPLES OF AGRICULTURAL ECOLOGY.

Introduction. — It was and is still believed that it is possible to define the relations between the plant and its surroundings, by calculating the coefficient of correlation between the meteorological data and the statistical data of yield.

Leaving aside, in the present case, the question as to whether the well known formula of correlations is applicable or not, the result obtained affords a purely illusive solution of the problem. The importance, for instance, of the April rains in Apulia (Italy) as related to wheat yield, is quite evident; representing such by the term r (coefficient of correlation between April rains and grain yield) = 0.7, we are nowise nearer the solution of the problem of a better adaptation of wheat-growing to surroundings.

Meteorology applied to agriculture, in so far as it is based on the correlation method, has introduced mathematics into a field in which it cannot give the good results that were anticipated.

Agricultural Ecology, in which the surroundings as related to the growth and yield of crops are studied, brings the whole of these researches into the field of biology, and, cutting entirely adrift from meteorology and agrogeology, opens the way to a new branch of research.

Having chosen as our starting-point the term "yield", from which

we gradually arrive at the definition of the "ecologic unit", we will now, leaving aside the numerous questions of detail, deal with the idea and principles which fundamentally define and limit the field of agricultural ecology. These principles should be closely followed by all those who desire to contribute, on an international plan of collaboration, to the development of this science.

Yield.

The yield of a plant is the result of a relation between its productivity and resistence to the adverse phenomena of its surroundings.

In order to illustrate clearly this fact, the example is mentioned of the work done at Svalöf with the object of combining in the best possible proportions the high productivity of *Squarehead* with the resistence to low temperatures of the native wheat. For this purpose three principal hybrids were produced: *Pansar* (for the southern part of the wheat area in Sweden), *Sol* (for the central part) and *Thule* (for the northern part).

The following table gives the data of grain yield in quintals per ha. for the three stations, Svalöf (long. 56°C.), Linköping (long. 58°N.) and Ultuna (long. 60°N.). Assuming the yield of native wheat to be 100, the corresponding yield of these three varieties is given in brackets:

	Svalöf	Linköping	Ultuna
Native of Scania	27 (100)	—	—
» » Ostrogothland	—	27 (100)	—
» » Ultuna	—	—	28 (100)
Thule II	—	39 (144)	32 (112)
Sol II	41 (150)	42 (155)	26 (92)
Pansar III	45 (167)	39 (144)	26 (100)

At Svalöf "Pansar" produced 67 % more than the native wheat of Scania; at Linköping, where it does not resist the cold sufficiently and is too late, "Pansar" gave way before "Sol", which yielded 55 % more than the native wheat of Ostrogothland; and at Ultuna, "Thule" gives the highest return, but yields only 12 % more than the native wheat of the district. Still further north the severity of the climate requires the highest resistence on the part of the native wheat, the yield of which is then superior to that of the hybrids; it is scarcely possible any longer to increase productivity at the expense of resistence to low temperatures.

To avoid excessive complication, the "quality" of the yield has not been taken into consideration. The yield is often in inverse ratio to quality, and this fact should be borne in mind in order to succeed in combining those characters most desired by the grower.

Productivity (the intrinsic quality) and resistence to the various adverse phenomena are what we propose to call "economic characters": the more harmonious the combination of these characters, the greater the quantity (or the higher the quality) of the yield.

Ecologic Constants. — Two varieties, of equal productivity and in the same surroundings, may yield very different results according to their degree of resistence to certain adverse conditions.

Seeing that each variety reacts in a different way and to a different extent under the same influence of the same factor, the limits and optimum values of outside factors should be determined, not for "wheat", but for each individual variety of this plant, and of pure growth if possible. We will class these limits and optimum values as "ecologic", to distinguish them from the physiological limits and optimum values, which are determined according to a given function, without taking into account the effects which such function may have on the final result or yield.

For a given variety, then, the ecologic optima of temperature, moisture, etc., from a given point in the growth period, will be those temperatures or degrees of moisture which act on the plant in such a way as to develop to the full its yield capacity.

The difference between ecologic and physiologic values may sometimes be very great. For instance, the physiological thermic optimum of growth for the "Bon Fermier" variety of wheat, acting on the plant at the tillering period, causes a vigorous growth of tillers, but prevents earing by increasing the leaf growth. The difference between the physiological and ecologic optima is, in this case, certainly more than 12°C.

It is therefore indispensable to determine for each form separately, in what way and to what extent the yield varies in response to the variations of a certain factor, and the optimum value of the latter from the ecologic point of view.

The Critical Periods. — The requirements of the plant very in the different phases of its growth in such a way that the same quantity of rain, for instance, or the same temperature may, as regards yield, have very different results according to the times at which this quantity of rain or the temperature acts on the plant.

In this respect, the critical periods are of very special importance.

The critical period as regards a given factor is the comparatively short part of the growth period during which the sensitiveness of the plant attains its maximum to such a point that the fluctuations of this factor then have a decisive influence on the crop yield.

The ecologic optima and limits should therefore be determined especially during the respective critical periods.

The *twenty* days before earing are a very important critical period for wheat as regards soil moisture. The following table shows the yields of 3 varieties of wheat in quintals per ha. corresponding to various groups of precipitation values which influence the plant during the critical period:

Precipitation in mm.	Coecitta	Real Forte	Gentil Rosso
0-5	4	3	1
6-15	8	9	5
16-40	8	15	13
41-70	15	20	25

With the precipitation data at our disposal for a certain period of time, 10 years for instance, it can be found how many times in the said period the total precipitations in the critical period was 0-10, how many times 11-40, and so on.

By comparing the frequency of the different rainfall values with the corresponding yield values (see table), other conditions being equal, the total yield of each variety can be calculated during the period of 10 years, and thus can be established a criterion, in connection with the "Spring drought" phenomenon, for the choice of the most suitable variety.

Determination of Characters. — Three varieties of wheat which, during the period of 10 years, give the same total yield, proving very resistent to drought, may derive this capacity from three different forms of adaption:

(1) reduction of leaf surface;
(2) reduction in the number of stomata;
(3) deeper root penetration.

At the same time, drought is not a simple phenomenon, but the result of several factors, the number and proportions of which vary from one district to another, so that there may be different types of drought, each of which will require special forms of adaptation on the part of the plant. A variety showing resistence in one locality may

prove less resistent in another, and vice-versa. Again, by crossing two forms having the same degree of resistence, which however, is due to two different causes, the two characters may possibly be united in a single type and thus the degree of absolute resistence be increased.

In order therefore to form an exact opinion on a given variety, it is necessary to individualise those special morphologic and physiologic characters on which depend its behaviour under the adverse conditions of its surroundings.

These delicate and important researches, especially during the critical period when the relation between the plant and this particular factor is closer, should be continued throughout a series of experiments which allow the different factors to be isolated and their intensity increased up to the maximum limit, in order to accentuate the special characters it is desired to reveal, bringing them into relief and detaching them so to speak, from the body of the plant and its functions as a whole.

Ecological Unit. — When these characters have been determined, we can, by suitable crossings, find out, basing on the laws of segregation and recombinations of characters, the genetic factor or group of genetic factors which govern the said characters.

However, with the same genetic factor or group of factors, the character which is the physio-morphologic expression of this factor or group of factors, may present itself under another aspect if the surrounding conditions be changed. There are forms which are generally awnless, but which, sown in certain places under different conditions as to physical surroundings, may become awned.

Analogous phenomena take place as regards the "soft" and "hard" characters of grain, presence or absence of pigment, and tillering: that is to say, most of the characters on which the present botanical classification is based!

In these cases, consequently, the existing genetic factor or group of factors do not determine in an absolute and constant way the character in question, but, under certain environmental conditions, cause, for instance, the formation of awns, whereas, under other conditions, though with the same genotype, the formation of this organ does not take place.

It is therefore necessary to establish within what limits the awns are formed and the optimum surrounding conditions and limits. If, for instance, temperature were the most important external fac-

tor in the formation of the awns, by drawing a circle round a point representing the factor or group of factors in question and marking in this circle the temperatures compatible with the normal growth of the plant, the awned and awnless sectors could be found.

The plant should therefore be carefully studied under all possible different environmental conditions in order to compel the genetic factor to show all its possible reactions.

Only thus can one be sure of having individualised a character to the extent of being able to distinguish with certainty the genotype of the phenotype. After having completed this analysis, in the presence of a certain character it can deduced what genetic factor or group of factors are concerned, and the modifications such a character will undergo in different surroundings.

The total of all the physico-morphologic reactions of a genetic factor or group of factors constitutes what might be called an " ecologiccal unit " (" econe ").

These units are, in a certain sense, comparable to chemical atoms, and if, in order to analyse a long series of compounds, it is necessary to know the elements of which they are composed, then by analogy, in order to find out the fundamental lines of the " wheat " phenomenon in its numerous phases, the ecologic units of which it is composed must be individualised.

After what has been said above, it clearly becomes necessary to extend the field of research to rare varieties and those of little economic importance, dispersed in regions far from the great centres of cultivation, because, from the very fact of their isolation, they may have, hidden away, a wealth of unknown genetic factors, and give rise, when crossed with other varieties or transferred to other surroundings, to new and very interesting reactions.

Agricultural Ecology, by the complete analysis of the surroundings extended to the ecologic units, reveals not only the nature of the relations existing between the plant and its surroundings, but offers a basis for all the operations tending to modify these relations, with a view to utilising the surrounding resources by the best possible combination of characters.

The ecological Problem of Wheat.

In 1920 an enquiry was opened, details of which were widely distributed to Agricultural Institutions all over the world. The strik-

ingly large quantity and valuable nature of the data thus collected, will be utilised in a monograph which will enable us to establish what will be the task of each station in the solution of the ecological problem of wheat.

The arrangement of the data will result finally in a double classification :

(1) Classification of adverse phenomena, quite independently of absolute meteorological factors, but taking into account the negative influence they have on the plant.

(2) Classification of wheats, quite independently of the botanical characters on which the present botanical classification is based, but taking into account the behaviour of each type in the presence of adverse phenomena.

Classification of adverse phenomena. — The classification of adverse phenomena is, as has been said, based on the influence they exercise on the growth and yield of the plant.

The following are the precipitation and temperature limits (the figures being taken for each month) relating to the different subperiods into which the growth period of wheat may be divided :

Limits		Sowing and harvesting	Tillering development	Earing and flowering	Formation and ripening of grain
Rainfall in cm.	maximum	200	80	—	60
	minimum	50	30	45	—
Temperature C°	maximum	—	+ 11	+ 28	+ 32
	minimum	—	— 5	+ 8	+ 8

The meteorological equivalent of the different adverse phenomena can thus be established preliminarily, though in a rather general way. When, for instance, spring drought in Italy is spoken of, it is understood that precipitations during the month preceding earing were generally below 45 mm.

Reciprocally, this equivalent being once established, the determination of the frequency of a phenomenon is greatly facilitated.

The following table, for instance, shows the rains for Foggia (Southern Italy) :

	1910	1911	1912	1913	1914	1915	1916
Sowing	132	65	69	160	28	121	115
Tillering	41	14	14	34	31	66	12
Earing	40	36	38	85	77	47	95
Formation and ripening of grain	45	102	47	55	[illegible]	[illegible]	15

For the period 1910-1916, then, there is drought *once* during sowing, *thrice* during tillering and *thrice* also in the spring (earing), and excess of rains *thrice* again during the sub-period between flowering and harvesting.

These remarks equally apply to the other phenomena.

A knowledge of the equivalents and the distribution of the meteorologic data over the different sub-periods, will then enable us to form at the outset an idea as to the climate of a given region as related to wheat cultivation (construction of the corresponding climoscope).

For each sub-period, the average monthly precipitations and temperatures are given, as well as the maxima and minima observed, etc.

The following is the climoscope for Temir (Asiatic Russia):

	1905	1906	1907	1908
Autumn period (sowing, harvesting, tillering)	4.5 mm. 31°.0 — 4°	19.3 mm. 36°.2 — 11°	16.6 mm 28°.2 — 11°.8	17.4 mm. 33.4 — 10°
Winter period (rest)	10 mm. 1[illegible].2 — 34°.3	20 mm. 22°.8 — 32°.9	12 mm. 20° — 38°.3	15 mm. 2[illegible]° — 3[illegible]°.[illegible]
Spring period (tillering, earing)	34 mm. 35° — 6°.6	17 mm. 37°.0 — 5°.5	15 mm. 36° — 0°.5	21 mm 35° 0°.8
Summer period (flowering, formation and ripening of grain)	44 mm. 32° 7°	47 mm 38° [illegible]°	25 mm 3[illegible]° [illegible]°	15 mm. 3[illegible]° 4°

Even a very rapid examination of this table will suffice to show the characteristic traits of the district: drought and cold for the greater part of the growth period (which render necessary irrigation and the choice of varieties which are resistent to low temperatures)

and an excessively high temperature during the formation of the grain (necessitating considerable earliness).

It is understood, that these meteorological equivalents are to be taken only in a general sense; they must, indeed, vary in relation to the other physical phenomena and with the different varieties of wheat. But they afford neverthleess, a sound starting point and indicate the direction to be followed in analysing the surroundings, which analysis leads us gradually to the discovery of the ecologic units.

Classification of wheats. — This classification as stated, is quite independent of the characters on which the present botanical classification is based, being based on the behaviour of each variety in the presence of adverse phenomena.

A conventional scale of values is drawn up, from 1 (minimum of resistence, etc.) to 20 (maximum of resistence, etc).

Such classification will enable us at the first glance to gain an idea as to the characters, qualities and deficiencies of the different varieties, and will form a valuable guide (taking into account the frequency and intensity of the adverse phenomena) in the choice of the best variety, the determination of the optimum area of distribution and the improvements to be made by selection and crossing.

The following, for instance, is a table relating to some Italian wheats:

Name of variety	Physiographic district	Torrential rains	Rust	Low temperatures	Drought	Liming	Wind	Fog	Productivity	Quantity of product
Biancuccia	Sicily	—	—	—	20	—	—	—	18	18
Rossarda or Capinera	Apulia	—	—	—	20	20	—	—	7	15
Trigu Canu	Sardinia	12	12	—	10	10	—	—	—	—
Biancone dell'Elba	Isle of Elba	15	15	—	10	10	—	—	15	—
Fucense	Central Italy	15	15	13	—	—	—	15	—	—
Civitella	Northern »	15	12	10	—	12	—	—	28	5
Gentil Rosso	N.-C. »	12	12	10	10	10	—	—	[illegible]	10
Quattro Coste, Rossolona	Northern »	15	12	13	—	—	—	—	—	—
Poulard Blanc	» »	20	5	17	—	—	—	—	18	—
Hâtif Inversable	» »	20	3	14	5	5	—	—	18	12
Restajolo	» »	13	13	15	—	—	15	—	—	—

The first column shows the district where the variety is grown: this knowledge is indispensable. A wheat considered as resisting low temperatures in a region with a warm climate may become very susceptible in one with a cold climate.

The Tystofte Smaahvede variety, very resistent in Denmark, cannot succeed some degrees further north, in Sweden, where it is classed among the varieties which are very sensitive to heavy falls in temperature.

The classification of the adverse phenomena (knowledge of the meteorological equivalents) and the ecologic classification of varieties enable us, from the first year, to utilise the observation data. Suppose, for instance, two varieties of wheat are grown in the same district and possess, in respect of resistence to drought, the empiric degree 15. In a year of intense drought a single record made according to special instructions will indicate a certain superiority in one of these varieties. We can then add some points to the latter (from 15 to 17, for instance) and give it the preference in places where, from agrogeological, topographical, or other causes, the influence of drought is more felt.

The monograph however should lead to the compilation of two large tables: that of the meteorological equivalents of the adverse phenomena in every country (with the corresponding climoscopes) and the general table of the varieties of wheat with their ecologic points, drawn up exactly according to their behaviour in the presence of these phenomena, of which the meteorological equivalents are given.

These tables, which show us, so to speak, the strong and weak points of each climate and each variety respectively, will enable us to state logically the ecologic problem of wheat, which aims at reducing as far as possible the conflict between plant and surroundings, and at obtaining, consequently, an increase in yield by suppressing the weak points and coordinating the strong ones.

The monograph which will synthesize all that it has been possible to establish up to the prsent time, is the natural starting-point for our work.

This monograph will be followed by others, and the analysis will be gradually extended to other crops: investigations as to maize, sugar-cane, cotton and the olive, are already under consideration.

III.

The international network of stations of agricultural Ecology.

The executive organ of our scheme of work is the *International Network of Stations of Agricultural Ecology*. The network has already

been sketched out by the various Institutes of Agricultural Research and Instruction, which, being furnished with laboratories, test stations, instruments and technical experts and qualified staffs, are now in a position to collaborate with us.

For practical purposes, moreover, the influence of temperature and moisture, in a great number of cases, on variations in yield due to physical phenomena, may be put at 60 %.

Once the problem regarding temperature and moisture is solved it can be said that in a great measure the work is accomplished.

At first, consequently, it would be sufficient to take biological observations as well as readings of the temperature, precipitation and soil moisture. Afterwards, the progress of the work itself, in connection with surrounding conditions, will indicate what other factors must be studied and what other points are to be cleared up. As a matter of fact, what we ask of our collaborators comes within the scope of the work which every agricultural institution, independently of our initiative, should accomplish in order to gain that knowledge of the surroundings which is indispensable in all agricultural research.

To facilitate the progress of research, at first our collaborators may limit themselves to the charts of the self-recording instruments, omitting the direct readings made 3 times daily, which involve work that everybody is not always able to undertake.

Moreover, for the purposes of our work, the information afforded by the charts is more complete than that resulting from the observations by the meteorologists' method. Of what importance to the plant indeed is an average temperature based on the three readings made at 9, 13 and 21 o'clock, without taking into account either the night or the other times of the day? The diagram of a thermograph, even of a mediocre instrument, is always superior, in that it gives us the temperature throughout and a very clear idea as to its distribution. But this is not all. Let us see what happens with the extremes of temperature. The thermometer at its lowest reading shows the degree to which the temperature fell, but gives no indication as to the duration of the depression. On the other hand it is clear that a fall to —5° for 2 hours may cause much more damage than a fall to —7° for a quarter of an hour only.

The same remarks apply to maximum temperatures. In any case, therefore, the charts are preferable to direct observation at fixed times. Direct readings taken at any time may however be

utilised to correct the diagram, by marking on the diagram the most striking readings taken during the week and registered in the notes. Afterwards, and as a consequence of the results obtained, it will perhaps be necessary to establish for each species a system of direct readings, the hour, date and frequence of which however will still be subordinated to the ecologic point of view.

We shall also have to subordinate the installation of the instruments to the ecologic point of view. The different depths at which the geo-thermometers are placed should be chosen with due regard to the thickness of the root mass, the arrangement of the soil layers, etc. It is not a question of controlling FOURIER's formula, indeed, but of knowing the temperatures which influence the root. As regards the method of observation also, we are obliged then to go farther and farther from the field of physics and enter once more fully into that of biology.

In the Stations of Agricultural Ecology, a series of observations are being made on the growth of plants and the conditions of the physical surroundings.

The programme of work at the Central Bureau with its network of Stations may comprise the four following phases :

(1) *Agronomy* : Determination of the yield of the varieties grown in a district under various conditions of soil and climate, never losing sight of the fact that yield is the result of a relation between productivity and resistence to adverse conditions.

(2) *Plant morphology and physiology* : Determination of the physio-morphological characteristics as connected with the expression of economic characters ; choice of pure lines in the ecologic sense.

(3) *Genetics* : Individualisation of the genetic factors which determine the above-mentioned characteristics ; crossing of varieties in the ecologic sense.

(4) *Ecology* : Determination of the ecological units and production of the best combinations with the object of obtaining the maximum yield.

Thus, starting with empiric knowledge (1), scientific knowledge (4) relative to the yield is obtained.

The plan of work, as we have conceived it, renders the collaboration of the Agricultural Institutions simple and easy, without it being necessary to have recourse to heavy expense for installation, and without necessitating at the same time excessive work on the part of the collaborators :

(1) Every observation, even if isolated and taken for one occasion only, will always be utilised within the plan in which the data are so to speak automatically classed and assigned a certain place. Nothing is wasted.

(2) All the stations installed in accordance with the instructions of the Central Bureau will be of the same value from the technical point of view. As regards the organisation of the Ecological Department, the differences between various countries in their advance in the domain of agricultural experimentation, therefore, only affect the density of the network. The Ecological Stations of the network are equal, both in the most advanced countries and in the most distant and isolated localities.

The network is therefore a single organism, established on a solid basis, and having a single dynamic centre.

(3) Uniform organisation, absolute unity of method and administration, lead to the true internationalisation of a service. The distribution of work, the scientific and methodical application and exchange of results, and, later perhaps, the transfer of observers from one country to another will open the way to collaboration, the importance of which it seems unnecessary to dwell upon.

G. AZZI,
Secretary.

R. PIROTTA,
President.

ENQUIRY ON DAIRY COW TESTING.

THE DEVELOPMENT OF THE DAIRY INDUSTRY IN INDIA. (1)

The development of the agricultural interests of India by State owned scientific departments only dates back about 20 years, and in the early days the first agricultural officers naturally devoted the major part of their energies to the improvement of the staple food crops of the people, with the result that the scientific development

(1) Report sent to the International Institute of Agriculture by M. S. A. HYDARI, Acting Under Secretary to the Government of India, Department of Education, Health and Lands, in response to a questionnaire on the "Testing of Dairy Cows".

of the cattle breeding dairying industry did not receive much attention until within recent years.

Much valuable pioneer work in the development of dairying in India has been done by the Military Department of the Government of India. The medical authorities responsible for the health of British troops stationed all over India became alive many years ago to the fact that the health of the soldier and his family depended largely on a pure and safe milk supply, and that the spread of epidemic diseases could not be prevented unless the supply of dairy produce was under such control as to render it safe. To provide this safeguard and to ensure that the soldier in India was supplied clean and pure milk and butter, the military authorities established their own dairy farms at all the large cantonments in the country. Between 1900 and 1910 some thirty military dairy farms were founded, and from the commencement these farms have been run on sound scientific principles, and have demonstrated to the community at large the possibility of commercial dairying on modern lines.

The combined milking herds of military dairy farms in India must at the present moment be not far short of 10,000 animals, and careful records have been kept of the yields of each individual animal which at any time belonged to the milking herds of these farms. By careful selection and breeding, pedigree pure bred herds of indigenous cattle of "Sahiwal", "Sindi" and "Hariana" cows and of "Murra" buffaloes have been built up, and much careful work done in crossing the milking breeds of Indian cattle with imported Ayrshire, Holstein,and Shorthorn bulls. Surplus bulls from the pure bred Indian herds at military dairy farms are sold to the general public and have done much to improve private owned herds in many parts of the country.

Military dairy farms in India have done pioneer work in connection with the growing of special fodder crops for dairy cattle, and the Government military dairies are equipped with modern milk pasteurising and cooling plant, mechanical refrigeration and cold storage.

In addition to dairy farms proper for the production of fresh milk from their own cattle, the military authorities have been the pioneers of modern factory dairying in this country. In 1910 the Government Central Butter Factory in Gujerat was opened by the Military Department. This creamery is equipped with the latest and most modern plant and during the war in addition to the supply of butter for troops in India and overseas, manufactured

large quantities of Cheddar cheese for the use of the Army in Mesopotamia.

The Imperial Department of Agriculture in India, as apart from the military dairy farms, first took up the question of the development of the dairy industry in 1906, when the then Director-General of Agriculture in India founded the existing herd of pure Sahiwal dairy cattle at Pusa. This herd was divided into two parts, one being developed as a herd of pure Indian cattle and the other crossed with European blood. The herd has since been greatly increased and by selection and breeding on milk producing lines, the average yield of the pure Sahiwal portion has been practically doubled since its inception. Crossing experiments with pure European breeds are still being carried on, the aim of this work being to discover whether the introduction of foreign blood is a practical proposal from the point of view of the development of the village cattle in India. Authentic records of yields of all individual animals have been kept at Pusa since the beginning and much valuable data concerning the chemical composition of the milk of Indian cattle, cross-breeding, etc., have been obtained and communicated to the Indian agriculturist through the medium of the Indian Agricultural Journal, bulletins and articles in the press.

A Central Cattle Bureau under the control of the Imperial Agriculturist to the Government of India, is about to be established at Pusa, and it is intended that this office should undertake the work of keeping and certifying pedigree records of Indian breeds of cattle, of promoting and controlling milk records of non-Government-owned herds and similar work.

In addition to the development of the dairy herd at Pusa the Government of India in 1919 established a special department at Pusa for the study of the very important question of animal nutrition. This department, which is now located at the Imperial Institute of Animal Husbandry and Dairying at Bangalore, South India, is under control of an eminent chemist designated the Government Physiological Chemist assisted by a highly trained staff, and the equipment of the laboratories, special cattle sheds, etc., devoted to this work are equal to that of any similar institution in any part of the world. The results of research work done by the Government Physiological Chemist and his staff are made available to the public in the usual way.

In 1920 the Government of India sanctioned the appointment

of a special expert officer known as the Imperial Dairy Expert to assist in the development of the Dairy-Cattle breeding industry, and in 1923 the Imperial Institute of Animal Husbandry and Dairying at Bangalore, South India, and the Imperial Cattle Farm at Karnal in Northern India were founded and placed under the charge of the Imperial Dairy Expert. The former Institution which is equipped as a modern Dairy College and Research Institute, in addition to accomodating the laboratories and offices of the Government Physiological Chemist before referred to, has a herd of about 200 cross-breed Indo-European milk cattle, a small herd of pure bred Sindi cows and a number of Murra milch buffaloes. This Institute is equipped with modern milk separating, pasteuring and bottling plant, mechanical refrigerating machinery, cold storage, modern butter making machinery, ghee-boiling plant, cheese-making plant, mechanical milking machine, electrically operated pumping machinery, food preparing plant, etc., and takes pupils for a special two years course for the Indian Government diploma in dairy farm management, as well as post-graduate pupils from the Indian Agricultural Colleges, and short course students actually employed in the dairy industry in the country.

The Imperial Cattle Farm at Karnal in the Punjab comprises an area of about 2000 acres of which 1600 acres are irrigated from the Western Jumna canal, and set apart for experimental cattle breeding. Up to the time of writing, herds of three indigenous breeds have been established at Karnal, viz : Thar-Parker, Hariana and Sahiwal, the aim being to demonstrate the usefulness and economic value of the dual purpose cow for India, *i. e.* a type of animal possessing milk producing qualities in the female and draught qualities in the male. A modern milk sterilising plant on the Mentor-Danish system has been installed at this farm to demonstrate the possibilities of milk sterilising and transport and the farm is used as a teaching centre.

The foregoing briefly indicates the activities of the Imperial Government in connection with the development of the Dairy Cattle Breeding Industry ; but in addition to this, much useful work has been done and is being done by the Agricultural and Veterinary Departments of Provincial Governments in India. These may be briefly recounted as follows :

Punjab. —Government owned cattle breeding farms have been established and grants of land for the development of cattle breeding

given to private individuals. The Hissar cattle farm of this province having an area of about 40,000 acres, is the largest of its kind in the East. Stud from this farm are distributed all over the province, and the Veterinary Department which is responsible for cattle breeding work in the Punjab is developing this breed along dual purpose lines, milk production being given a prominent place, among qualities necessary for selection of stud bulls in the herd.

The Punjab Government Agricultural College at Lyallpur has a pedigree herd of Sahiwal dairy cattle and the College dairy is equipped with modern milk pasteurising plant, refrigerating machinery, etc. Dairy instruction is given to all agricultural students.

United Provinces. — This Government employs a special whole-time expert officer for cattle breeding and dairying who is a member of the Agricultural Service. Government cattle breeding farms have been established and stud bulls are issued to villages from these institutions. The aim of the Agricultural Department of this province is to develop indigenous breeds of cattle along dual purpose lines. *i. e.* milk and draught.

The Agricultural College at Cawnpore has a dairy with a pedigree herd of first class Sindi cows and teaches the elements of dairy farming to all agricultural students.

Bihar and Orissa. — A Government Cattle Farm is maintained at Sabour under the control of the Agricultural Department, and the work carried on there has the object in view of improving local breeds on dual purposes lines, and stud bulls from the Goverment. Farm are issued to local breeders.

Bengal. — The Government of Bengal has a pedigree herd of Sindi cows at the Agricultural Institute at Dacca and a large cattle breeding farm at Rungpur. At the latter farm much good work has been done by crossing the local small sized cattle with Thar-Parker and pedigree Hariana bulls, the latter obtained from the military farms department. Stud bulls are issued to village communities and private breeders from Rungpur Farm.

Central Provinces. — A special whole time expert officer employed by the Agricultural Department of this province for cattle breeding and dairying. About ten Government owned cattle breeding farms have been established throughout the province. Stud bulls are reared at these farms, purchased from military dairy farms and the Agricultural Departments of other Governments, for sale and issue to breeders. The aim of the Department is to improve indigenous

breeds along dual purpose lines by crossing with outside Indian breeds of known merit, selection etc.

The development of co-operative dairying has had some degree of success in this province, the Telinkeri Co-operative Dairy Society for the production and supply of fresh milk to Nagpur city being the largest and most successful concern of this nature in India. This Society was promoted and fostered by the Agricultural Department of the local Government.

The Government Agricultural College at Nagpur has a herd of Ayrshire-Indian cross breed dairy cattle and a dairy fitted with pasteurising plant, mechanical refrigerating, etc. Dairy instruction is given to all agricultural pupils.

Bombay. — Of late years the Agricultural Department of this province has done much to develop the dairy cattle breeding industry within its borders. A whole time expert officer of the Agricultural Department is employed for dairy-cattle breeding. Government cattle farms exist at five different centres and pedigree herds of Amrit-Nahal, Kankrei, Khilari, and Sindhi breeds of cattle are maintained and stud bulls of all these breeds issued to village communities, private breeders, etc.

The Government of Bombay two years ago appointed a special commission to enquire into the whole question of cattle breeding and dairying and to make recommendations, and in pursuance of the recommendations of this body this Government is at the present moment taking steps to establish additional cattle farms, provide reserve supplies of fodder against famine years, etc.

The Government Agricultural College at Poona has two herds of pure bred Sindi cows and Surti milk buffaloes, and a small dairy. Elementary dairy instruction is given to all agricultural students and plans have been prepared by the Imperial Dairy Expert for the building and equipment of a modern college at Poona, which it is hoped will be established next year.

Madras. — A whole-time expert officer of the Agricultural Department is employed for cattle breeding and dairy work. Government cattle farms exist at three different centres in the province. Pedigree herds of Ongole and Kangyam cows and of the local milch buffalo are maintained and stud bulls are issued to the public from these farms. A dairy herd of Ayrshire-Indian cross bred cows is kept at the Government Agricultural College, Coimbatore, and the college dairy is equipped with modern milk pasteurising and re-

frigerating plant. Dairy instruction is given to all Agricultural students.

Burma. — A small dairy herd of pedigree Sindi cows is maintained at the Agricultural College, Mandalay, for the instruction of agricultural students.

The Agricultural Departments of some of the Indian States have of late taken a considerable interest in the development of the dairy-cattle breeding industry. The Government of Mysore employs a full time expert officer of the Agricultural Department for dairy-cattle breeding work. The Government of His Highness the Gaekwar of Baroda maintain a pure bred herd of Gir cows and Jaffarbadi buffaloes and issue stud bulls of these breeds to village organisations, and herds of local breeds have been founded by the Governments of Hyderabad, Gwalior, Dhar and Patiala.

That the Municipal Corporations of the larger Indian cities are alive to the importance of more perfect supplies of fresh milk is evident from the fact that the Corporation of the City of Bombay employ a special dairy expert with the highest scientific qualifications, in their health department, and both this corporation and the Municipal Corporation of the City of Rangoon have on foot extensive and well considered schemes for the closer control of the existing milk industry of their cities and the provision of better, cleaner, and cheaper supplies in the future.

The dairy cattle breeding industry in India is in a backward condition and will probably continue so far many years, but the foregoing will show that those responsible for the agricultural progress of the country recognise the importance of the development of this great industry and, consistent with the means at their disposal, are doing everything possible to further the cause of dairy progress on sound lines.

W. SMITH,
Imperial Dairy Expert (India).

ENQUIRY ON LOCUST CONTROL.

Locusts in Cirenaica.

Report from the Government of Cirenaica, transmitted to the International Institute of Agriculture by the Italian Colonial Ministry.

In Cirenaica up to the present there have been no other important invasions of locusts except that recorded in May 1918.

Almost every spring however the presence of locusts is observed in

Bengasin and on the table-land, but they scarcely ever do serious damage to the crops.

On the supposition that these Orthoptera might later on cause damage to the crops, the Government of Cirenaica have directed the Department of Agriculture to collect promptly all the data necessary for organising measures of control against locusts, and to transmit these data to the International Institute of Agriculture.

Locusts in Tripoli.

Communication from the Government of Tripoli transmitted to the International Institute of Agriculture by the Italian Colonial Ministry.

In Tripoli, from the date of the Italian occupation, there have fortunately never been any flights of locusts, except on one occasion towards the end of 1914, of slight importance and finishing in the sea. This occurred in the Gebel coastal zone and that of Ghibla, West and East, under our dominion. It has not been possible up to the present to get direct information as to invasions which may have taken place in the districts farther in the interior (Fezzan, Gat, etc.), though the probability of such may be almost excluded, since from the caravans and the natives coming from those parts news of flights would have been received, seeing the disastrous effects of these invasions on the agriculture of the Sahara oases.

ENQUIRY ON THE PREVENTION OF ANTHRAX INFECTION OF HERDS.

Report.

In carrying out the decision of the General Assembly of the International Institute of Agriculture, May 1924, the questionnaire relating to this enquiry was sent to all the adherent States of the Institute as well as to 44 other Countries and Colonies.

At the request of the International Labour Bureau important information has been collected and is now being elaborated for inclusion in a report which will be sent, in October 1925, to the next meeting of the Agricultural Advisory Committee, which is composed of three members of the Administrative Council of the International Labour Bureau and three members of the Permanent Committee of the International Institute of Agriculture.

ENQUIRY ON THE STOCK BREEDING SERVICES AND HIGHER INSTRUCTION IN STOCK BREEDING.

The first results.

The questionnaire relating to this enquiry has been sent to the 71 adherent States of the Institute as well as to 44 other countries and Colonies.

The Institute has, up to the present, received about 55 replies, accompanied by numerous schedules. The information collected will be elaborated for inclusion in a monograph on the question, to be compiled in collaboration with Prof. B. MAYMONE of the Italian Council of the Association of Travelling Chairs of Agriculture.

ENQUIRY AS TO THE RESULTS OBTAINED BY FARM ACCOUTANCY.

New Enquiry.

The Bureau of Agricultural Science of the International Institute of Agriculture has organized an enquiry on the results obtained by means of agricultural book-keeping according to the method proposed by Prof. LAUR (Organization of international statistics based on the results of investigations carried out with the assistance of agricultural book-keeping. *Int. Rev. of Science and Practice of Agric.*, N. S., Vol. II, No. 3, 1924).

A preliminary exchange of views has taken place with Prof. LAUR himself, Prof. TAYLOR, Chief of the Bureau of Agricultural Economics, U. S. Dpt. of Agriculture, Washington, and Prof. P. BORGEDAL, Chief of the Agricultural Book-Keeping Bureau of « Det Kgl. Selskap for Norges Vel », Oslo.

The subject will be discussed also by the Committee on Agricultural Economics of the Ministry of Agriculture and Fisheries, London.

AGRICULTURAL INTELLIGENCE

AGRONOMY.

Soil Science.

See R. Part II, *Proceedings of the International Society of Soil Science*, Abstracts.

Fertilisers and manures.

556. **Fertiliser Tests with and without Ground Limestone.**

BLAIR, W. S. (Superintendent, Dominion Experiment Station, Kentville, N. S.). *Scientific Agriculture*, Vol. No. 6, pp. 199-201. Ottawa, 1923.

The test was started in 1914 to ascertain the most profitable source of nitrogen and phosphorus; on a similar series of plots ground limestone was applied to gain information as to its value when used in conjunction with such fertilisers. A three-year rotation of potatoes, grain, clover and timothy hay was followed.

Potatoes are not a good crop for experiments in which lime is continuously applied, owing to the fact that it favours scab, which in this case reduced the market value of the crop. In every instance there was a marked increase in yield of the limed over the unlimed plots.

Nitrate of soda gave slightly better results than sulphate of ammonia. On the unlimed, sulphate of ammonia plots, acidity increased. Basic slag gave slightly better returns than acid phosphate. Limestone was of greatest benefit to clover and to the hay crop. Wheat responded in a marked degree to lime. Limestone should not be applied to a potato crop. To apply when sowing with grain is advisable.

Limestone more than doubled in quantity the hay crop and gave hay of better quality. Its use enables clover to be grown on soils which otherwise would not grow this crop. W. S. G.

557. **Nitrifying Bed for Prevention of Nitrogen Losses from Cattle Urine.**

JOSHI N. V. (First Assistant to the Imperial Agricultural Bacteriologist). *Agricultural Journal of India*, Vol. XX, part. I, pp. 20-30. Calcutta, 1925.

Large losses of nitrogen occur when cattle urine is kept under aerobic conditions. The author carried out experiments to ascertain whether this loss could not be prevented by employing some form of nitrifying bed in which bacteria would convert the nitrogen into nitrates. Two methods were found : in the first, the urine is passed over a nitrifying bed and a solution of nitrates is obtained ; in the second method the urine is absorbed by means of a specially prepared or activated soil.

In the first method, pumice or broken bricks form the bed ; the urine is diluted with ten times the quantity of water and nitrification takes from 8 to 10 days, under the conditions of the experiment.

Even with crude methods of handling, allowing a loss of 40 to 50 % of nitrogen, it is estimated that 1 to 1.25 maunds (1 maund = 82 lb.) of potassium nitrate per annum could be recovered from the urine of one animal, if converted into potassium nitrate by this process of intensive nitrification.

W. S. G.

558. **Manurial Value of Sugar Cane By-Products.**

DYMOND, G. C. *Sugar*, Vol. XXVII, No. 3, pp. 134-135. New York, 1925.

Sugar cane requires about nine primary chemical substances as plant food material, and the deficiency of any one of these, and not the superabundance of the others, determines the crop yield, hence the importance of returning to the soil, residues containing chemical bodies removed by the crop.

Samples of cane trash and tops were taken from a 15 months old plant cane ; the stalks showed an average sucrose content of 12.4 %.

Analyses of the dry substances were made, the ash giving the following results :

Tricalcic phosphate : in trash, a trace ; in tops, 6 % or 17 lb. per acre.

Potash : in trash, 3.2 % or 15 lb. per acre ; in tops 23 % or 77 lb.

Magnesium oxide : in trash 1.8 % and 6.17 % in tops.

Chlorine : 0.5 % in trash and 9.4 % in tops.

The value of the dry trash is about 4s. 3d. per ton, or 12s. per acre, and that of the dry tops 19s.9d. per ton, or 38s. per acre.

On a crop of 100 000 tons of cane the value of the dry tops would be £6170 and that of the trash £1550.

Analyses of the bagasse ash showed : silica 66.5 % ; tricalcic phosphate 3.2 % ; potash 4.4 % ; sulphates 12.63 % ; the total value of the potash and phosphate being 19s. 7d. per ton.

Dry filter press cake contained : nitrogen 1.06 % ; phosphate 3.13 % ; potash nil ; the value works out at 18s. 7d. per ton. This cake is very suitable for light soils when applied at the rate of 6 to 8 tons per acre.

[557-558]

The manurial value of molasses works out at [illegible] per ton, or £[illegible] per 100 000 tons of cane, of which £1276 is due to the potash content. The most scientific method of dealing with this product is first to obtain the sugar value in alcohol, and than to utilise the residue as manure.

Sugar cane should not be an exhaustive crop if, as is possible in practice, a large proportion of the chemical substances removed by the crop are returned to the soil. W. S. G.

559. **Basic Slags and Mineral Phosphates.**

VANSTONE Dr. E. *Journal of Agricultural Science*, Vol. XV, Part 1, pp. [illegible]-46, figs. 2, bibliography. London, 1925.

With reference to the evaluation of basic slags, there is still much difference of opinion as to the value of the citric solubility test.

In order further to study the question the author investigated the relationship between phosphate soluble in 2 % citric acid and total phosphate of known composition, basic slags and mineral phosphates.

In the case of ferrous and ferric phosphates, aluminium phosphate, dicalcium phosphate and apatite it was found that, after 30 minutes shaking in 2 % citric acid solution: apatite was totally insoluble, ferric phosphate almost insoluble, ferrous phosphate and dicalcium phosphate almost completely soluble. The results obtained are shown in Fig. 116, from which it will be seen that the graphs are straight lines (except aluminium phosphate), and that they pass through the point of origin.

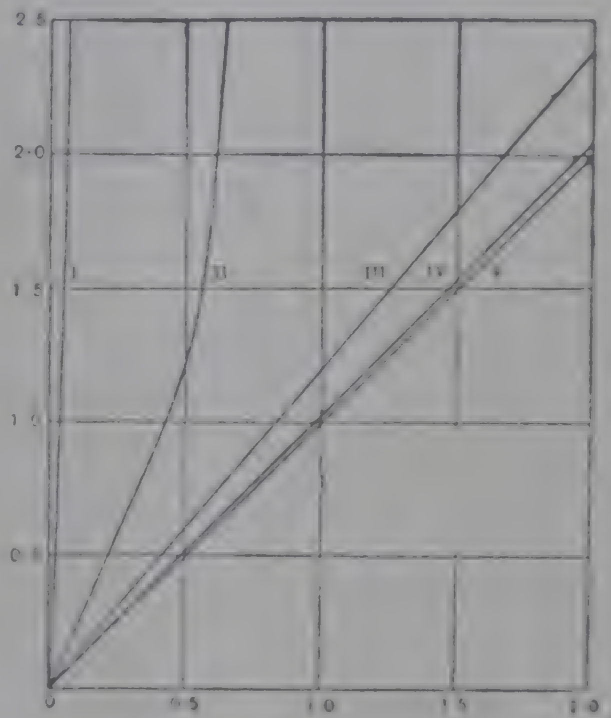


FIG. 116. — Solubility curves of phosphoric acid in various phosphates:
I. Ferric phosphate and apatite.
II. Aluminium phosphate.
III. Mixtures of calcium carbonate and tricalcium phosphate.
IV. Ferrous phosphate.
V. Dicalcium phosphate.
Ordinate = gms. of P_2O_5 present.
Abscissa = gms. of P_2O_5 soluble in citric acid.

In the case of each of the three basic slags of widely differing solubility, the graph is a straight line showing that citric solubility is a constant, independent of the weight taken in the test. The ratio of soluble phosphate to total phosphate in the case of the mineral phosphates Gafsa, Egyptian,

Nauru and the West Indian phosphate, Buccaneer, depends on the weight taken in the test, and the graphs are curves (fig. 117). The author carried out experiments with beans in order to ascertain if there is any relationship between citric solubility and plant growth, and obtained conclusive evidence that the intake of phosphoric acid from basic slags is directly proportional to citric solubility. W. S. G.

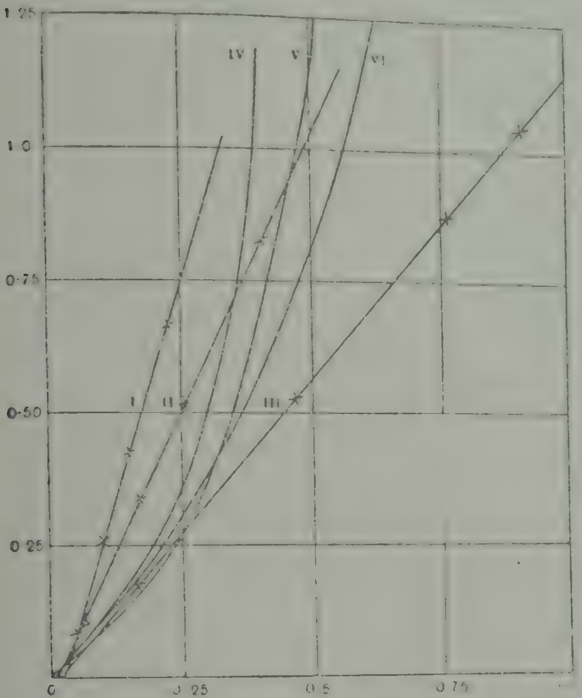


FIG. 117. — Solubility curves of phosphoric acid in various phosphates.

Ordinate = gms. of P_2O_5 present.
Abeissa = gms. sf P_2O_5 soluble in citric acid.

I. = Low grade Basic Slag 18 %
II. = » » » » 21 %
III. = High » » 37 %
IV. = Nauru phosphate
V. = Gafsa.
VI. = Bucaneer.

560. **Recovery of Potash from Steffan Waste Water.**

GELDARD, W. J. and CHASE, W. D. *The Planter and Sugar, Mahufacturer*, Vol. LXXIV, No. 11, pp. 208-210 tables 7. New Orleans, 1925.

In the manufacture of beet sugar, molasses is produced in much the same manner as in the case of cane sugar. In the process of fractional crystallization, molasses, a residual liquor, is produced which still contains about 50 % of sugar and this is recovered by the Steffan lime, or similar process; a waste product results known as Steffan waste water, containing about 3 % solids, which consist of nitrogenous and other bodies.

Statistics show that that annual production of Steffan waste water in the United States is about 2,500,000 tons.

If the evaporation of the waste water is controlled so that a definite specific gravity is obtained, potash salts will separate out practically free from salts of sodium or other metals. The author's experiments indicate a possible yield of 227 lb. of crude salts, or 199 lbs. of recrystallized salts per ton of concentrated water. The original waste water with a dry substance content of 2 to 4 % must be evaporated until the content is about 68 %. The production of potash salts during evaporation should form only a part of a complete system of recovery of waste products. W. S. G.

561. **World's Situation as regards the Nitrogen Problem.**

Nitrogen Survey, part. I. FOSTER BAIN, H. and MULLIKEN, H. S. The Cost of Chilean Nitrate. *United States Department of Commerce. Trade information Bulletin*, No. 170, p. 69. Washington, 1924.

Part II CURTIS H. A. General Review of the Nitrogen Situation in the United States. *Bull.* No. 226, p. 63, figs. 6. *Ibidem.*

Part III. BRAHAM J. M. The Air-Nitrogen Processes. *Bull.* No. [illegible], p. 41. *Ibidem.*

Part IV. CURTIS H. A. and ERNST F. A. The Nitrogen Situation in European Countries. *Bull.* No. 270, p. 49. *Ibidem.*

The greater part of the fixed nitrogen used at present throughout the world is from Chilean nitrate, which is a trade monopoly. The necessity of rendering the various countries independent in this respect is evident, for, seeing that nitrate is largely used in agriculture and as a raw material in many industries, and also that it is used in the manufacture of explosives for military purposes, it may be of considerable importance in national security. The present article is a summary of an investigation which has been made with the object of ascertaining whether it is possible, in this respect, to ensure America's independence of the Chilean monopoly.

The world's situation, then, as regards the nitrogen problem, is examined, the state of the trade in Chilean nitrate and of the nitrogen industry in the United States being first studied. The enquiry then passes to a review of the different processes by which nitrogen may be obtained from the air, and to the state of the problem in European countries.

Chilean nitrate. — For the present it need not be feared that the supply of raw material in Chile will be exhausted; it will probably supply nitrogen for one or more centuries. Nor is it improbable that later on a reduction in the price of nitrogen itself will be realised; this will mostly depend on competition with other means for producing nitrogen. Such reduction however cannot be based on the lower cost of extraction from raw material; it is probable indeed that there will be a rise in prices under this head owing to the increased demands of the workers. On the other hand improvements in the processes employed may take place through the use of more suitable methods, a 25 % increase in yield being thus obtained, while the opening of large central establishments will lead to a saving of 25 % in the cost of production. In these conditions also lower grade materials may be used, thus increasing production. On the other hand it will be difficult to obtain reductions in the cost of transport and further treatment in the producing country.

Export duty forms one of the chief items of secondary expenditure: at the present rate of exchange for the pound sterling (4.9[illegible]) it amounts to 10.46 dollars per short ton (q. 9.0718). The importance of this item of the cost of nitrogen depends on Chile itself, which, in view of competition, may reduce her tariff. An increase, however, of 1-2 dollars per ton may take place in the cost of sea transport, which is now somewhat low. It should also be considered that at present the rate of exchange for the *peso* is favourable to America to the extent of 5.93 dollars per ton, but with the adjustment of the rate of exchange, this advantage will gradually cease.

Speaking generally therefore, so long as no substantial reduction in export dues takes place, it may be concluded that the increase for sea freight and the variations in the exchange may counterbalance reductions in the cost of production and also lead to a slight increase of the final price in American ports. This may be put at 30 dollars per ton payable within a short period and 35 dollars for a longer period.

Exportation of Chilean nitrate.

Countries exported to	Tons exported	% received
Europe and Egypt	896 411	71.6
United States	279 169	22.3
Other countries	76 470	6.1
Total	1 252 050	100.00

Situation in the United States. — Home production is from : (1) Ammonium nitrate obtained as a by-product from industries using coal ; of this 1/3 is exported and the rest is used in other industries and, especially, in agriculture ; (2) Organic ammonia obtained from cotton-seed meal, etc. a small part is exported amd the rest is used for the production of mixed fertilisers ; (3) Atmospheric nitrogen, produced in small quantities only.

The United States chiefly import Chilean nitrate ; then comes 50 000 tons of Canadian cyanamide and a few thousand tons of Norwegian nitrate and organic ammonia (dried blood, guano).

The requirements of agriculture and industry in the matter of nitrogenous products are various, for the former chiefly needs nitrogen and the second one or another of the salts. In agriculture it may be a matter of indifference whether Chilean nitrate or atmospheric nitrogen be used, but this is not the case in industries. But there are also various requirements as regards the nitrogen used in agriculture ; thus ammoniacal nitrogen, produced at a very low cost, is not directly utilisable and must be combined with sulphuric or phosphoric acid for which purpose other plant is necessary. Following on industrial progress, a gradual reduction in the price of nitrogen may be obtained, but it will be long before such reduction can be felt in agriculture.

Production and Consumption of nitrogen in the United States (1922).

	short tons
Nitrogen distilled from coal	9[illegible]
" " " bones	200
Atmospheric nitrogen	3 000
Nitrogen imported (exclusive of blood, guano, etc.)	116 861
Total	219 661
Exported	39 389
Consumption	179 671

[561]

Putting the consumption in round figures at 180 000 tons, this is equivalent to 900 000 tons of ammonium sulphate and 1 154 000 of Chilean nitrate. For 1925 the figures are about 260 000 tons:

Production of atmospheric nitrogen. In less than 20 years this process has developed from a simple laboratory research to an industry which can produce yearly more than 550 000 tons of fixed nitrogen. This quantity, converted into sodium nitrate, would yield 2 565 000 tons, *i. e.* a larger quantity of nitrate than is exported annually from Chile: converted into ammonium sulphate it would yield 1 640 000 tons, equivalent to that obtained from 155 000 000 tons of coal. This industry has certainly not yet reached its full development; the essential thing is that nitrogen may be obtained at a lower price than that realised for the increase of agricultural produce obtained by its use.

The processes for the fixation of atmospheric nitrogen are chiefly the voltaic arc, cyanamide and synthetic ammonia; the cyanamide process is now followed in small establishments. The synthetic ammonia process seems to promise best, but the industry for the fixation of atmospheric nitrogen is still in its infancy and its future development cannot yet be foreseen.

The war has given a great impulse to this industry.

In 1923 the production of atmospheric nitrogen was 496 000 tons, viz. 36 000 by the arc process, 140 000 by the cyanamide and 320 000 by the synthetic ammonia. process.

The nitrogen situation in European countries. Besides Chile there are few countries in the world which export nitrogen. Among these is Norway, which has greatly developed the atmospheric nitrogen industry and has slight need of it in agriculture; Great Britain also exports more nitrogen than it imports owing to the fact that agriculture makes small demands on its supply, and the coal-industry production is large. Before the war Germany was one of the largest consumers of Chilean nitrate instead of which it can now supply its own needs, and not improbably will become an exporter. The majority of the most densely populated countries import nitrogen and it may be predicted that even if the nitrogen-producing industries develop in them, local production will always be insufficient.

Of the following data (expressed in tons of fixed nitrogen) some have been taken by the authors from those supplied by the International Institute of Agriculture.

Germany: (fiscal year 1922-23).

Production of fixed nitrogen	Tons
From coal	75 000
Cyanamide	35 000
Synthetic ammonia	210 000
Total	320 000
Consumption in 1922	295 000

France : Imported 68 453 ; Exported 8 400 ; Consumed 69 000.

United Kingdom : Nitrogen produced in the coal, iron, etc. industries (1921) 54 333 (256 895 of ammonium sulphate) ;

Imports (guano and nitrates) in 1923 : 12 622 ;

Exports (guano, nitrates, ammonia products) in 1923 : 56 272 ;

Consumption (1922) : ammonium sulphate 159 222 ; sodium nitrate 33 831 ; guano 15 816.

Italy (1922) : Nitrogen produced : 6 700 ; Imported : 8 720 ; Consumed : 15 420.

During the war the cyanamide industry reached an annual capacity of 18 000 tons of nitrogen ; at present the output is a third of the capacity. There are two synthetic ammonia plants for the production of nitrogen by the Casale prooess and one by the Fauser. The consumption of nitrogenous products is less than before the war.

Norway : Production exceeds home needs for the atmospheric nitrogen industry is greatly developed owing to the low cost of hydraulic power. The following were exported in 1922 :

	Tons
Fish meal and guano	6 734
Calcium nitrate	157 562
" cyanamide	3 892
Sodium nitrate	32 402
?	1 673

The war led to a considerable increase in the exportation of nitrogen, causing a rise of from 16 829 in 1913 to 29 562 in 1916 ; in 1922, 21 890 tons were exported.

The following are the figures for other European countries :

	Tons of fixed nitrogen		
	Imported	Exported	
Sweden	6 011	1 763	(1923)
Spain	17 200	—	(1922)
Switzerland	1 335	470	(1923)

For Belgium, Denmark and Holland the article gives the data supplied by the International Institute of Agriculture.

A. F.

562. **The Action of Manganese Sulphate in the Mineralisation of Nitrogen.**

LEONCINI, G. and ROGAI, F. A. (R. Istituto di chimica agraria di Pisa). Saggi sull'azione nel terreno del solfato manganoso nella mineralizzazione dell'azoto di alcune sostanze proteiche. *Le Stazioni Sperimentali Agrarie Italiane*, Vol. LVII, parts 7-9, pp. 282-295. 3 plates. Modena, 1924.

Though it be admitted that manganese conpounds added to the soil may act as oxidising catalysers in one of the various chemical and biolo-

gical processes which take place in the soil, nothing can be foreseen as to the possible influence of such compounds on the complex bacterial process by means of which the nitrogen of the protein compounds is reduced to ammonia. A slow release of oxygen through the agency of the manganese compounds might be useful in the decomposition process and accelerate the production of ammonia. Whether it is a question of a true catalyptic influence or of a stimulating or depressing action by the Mn-ion, can only be ascertained by experiment.

From preliminary tests in aqueous solutions of urea, asparagine, acetamide, and meat peptone, the authors have observed that manganese dioxide or salts (manganese sulphate or chloride) do not favour the formation of ammonia.

From tests made in clay and sandy soils, the authors have observed that manganese, added as manganese sulphate, has no influence, either beneficial or detrimental, in the reduction of organic compounds present in dry blood or albumen, and in the mineralisation of nitrogen, dry blood and albumen. It may therefore be concluded that manganese takes no part in the bacterial process and that consequently there is no beneficial action by the catalyptic properties of the manganese compounds, nor any physiologically stimulating action by the Mn-ion.

Manganese is in nowise concerned with the continuance, on the other hand, of mineralised nitrogen accumulated in the soil in consequence of the reduction of albumen and dry blood, whereas it seems that a preservative influence may be attributed to the SO_4-ion. A. F.

Agricultural Botany, Chemistry and Physiology of Plants.

563. Investigations on the Environmental Conditions which Influence Plant Life, made in the Laboratory and Experimental Ground of Prof. Dojharenko at the Moscow Agricultural Academy.

I. — DOJHARENKO, Prof. A. G. Physical methods applied to the experimental study of agricultural questions (Agro-physicheskie metody laboratornago izuchenia voprosso polevodstva). *Nautchno Agronomicheski Zhurnal* (Journal of Agronomic Science), Year I, No. 2, pp. 90-114, figs. 12, diag. 1, Moscow, 1924 (received January, 1925).

II. — DOJHARENKO, Prof. A. G. The Utilisation of Solar Energy for Field Crops (Ispolzovanie solnechnoi energii polevymi kulturami). *Ibidem*, No. 1, pp. 7-21, fig. 1, diagr. 1, plates 7.

III. — DOJHARENKO, Prof. A. G. Soil and Subsoil Permeability and its Importance to Field Fertility (Vodopronitzaemost potchv i gruntoff kak faktor plodorodia polei). *Ibidem*, No. 4, pp. 250-268, fig. 3, diagr. 1, pl. 4.

IV. — TROFIMOFF, A. B. Some Results of Investigations on Soil Permeability on the Experimental Ground of the Agricultural Academy [formerly known as the Petroffskaya Agr. Academy] (Niekotorye resultaty izuchenia vodopronitzaemosti potchvy na opytnom pole selsko-khosiastvennoi (b. Petrovskoi Akademii). *Ibidem*, No. 4, pp. 269-273, 3 plates, 1 diagram.

V. — DOJHARENKO Prof. A. G. Investigation on Soil Evaporation (K iz-

cheniu ispariaiustchei sposobnosti potchvy). *Ibidem*, No. 5, pp. 339-374, fig. 1, pl. 4, diagr. 1.

VI. — KUDRIAVTZEFF A. Oxygen and the Roots of Plants. (Potrebnost kornei rastenii v. kislorode). *Ibidem*, No. 1, pp. 48-67, figs. 2, diagr. 1, pl. 14.

VII. — KUDRIAVTZEFF, A. The Transformation of Nitrogen compounds in the Soil and their Relation to Nitrification, (Prevraschenie form azota v pocthve v sviazi s nitrificatziei). *Ibidem*. No. 4, pp. 297-311, diagr. 4, pl. 6.

I. The principle that the improvement of agricultural technique should be based on exact knowledge of, and, as far as possible, on the quantitative determination of the factors which are concerned in plant life and that may be modified by cultivation processes, induced the author, in his laboratory and on the experimental grounds annexed thereto, to undertake a series of investigations intended to include all the factors which determine soil fertility and influence plant-life development.

The author divides these factors into three categories. The most essential are 5 in number, air, water, mineral and organic nutrients, light and temperature. The secondary or indirect conditions are: soil structure, stability, biological activity and decomposition of organic matter In the third category the author ranks adverse influences: plant diseases and pests.

Each of these subjects for investigation is subdivided into several heads, the majority of which required preparatory work for the choice of methods. Indeed, while as regards some questions the methods were amply developed and perfected, there were many which could not be sufficiently investigated by existing methods, while in the case of others, which had not yet been touched, the author had to begin by finding the appropriate method of investigation. Thus, it was possible for him to adopt the chemical methods applied to the study of plant nutrition, almost without modification, whereas for questions which can only be solved by the application of physical methods the author had to trace out a new way and invent the apparatus necessary for the investigations.

As a guide in the investigations the author drew up the scheme which is given below: among the applied methods as given in the third column, those which were worked out by the author and his collaborators are marked by an asterisk:

Fundamental factors	Questions to be solved	Methods
Water	Hygroscopicity Distribution (depth) Permeability Evaporation Capillarity	Weighing Electrometric Alcoholic * Pyknometric Hydrometric * Psychrometric * Potometric *

Fundamental factors	Questions to be solved	Methods
Aeration	Atmospheric reserve, its composition. Interchange of gases Diffusion Thermic respiration of the soil Porosity Permeability to air	Absorption and pumps * Eudiometric * Hydrostatic * Pyknometric * Potometric *
Nutrition	Reserve of N, P, and other elements Their distribution (depth) Their compounds Exchange and transformation Soil extracts Osmotic pressure Concentration Electric dissociation Colloids Acidity	Calorimetric * Fractional hydrolysis * Oil emulsion * Cryscopic Electric conductibility Interferential * Electrometric (concentration of H ions)
Biological activity the of soil	Evolution of CO_2 Microbiologic reactions Number of bacteria Change in the microflora Formation of spores	Absorption by plate cultures by the Hiltner and Remy method Fractional sterilisation
Decomposition of organic substances	Organic compounds Their distribution (depth) Haulm residues	Hydrolytic * Leaching
Soil structure and stability	Capillarity and interstics Soil fixation	Pyknometric * Gelatine treatment Freezing
Solar energy	Coefficient of energy utilised	Calorimetric
Infection of fields	Infection of the soil » » of seed » » of crop	Solution of DREYER, MALTZEW, PRAUS KIER Weighing * Analytical control
Crop	Estimation of yield » » of quality	Mathematical Analytic control

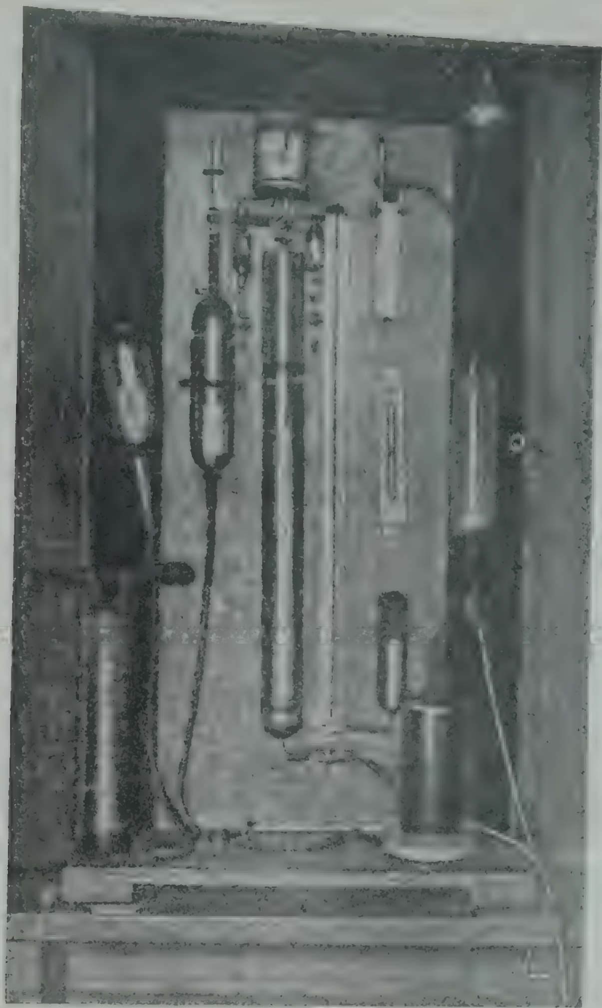
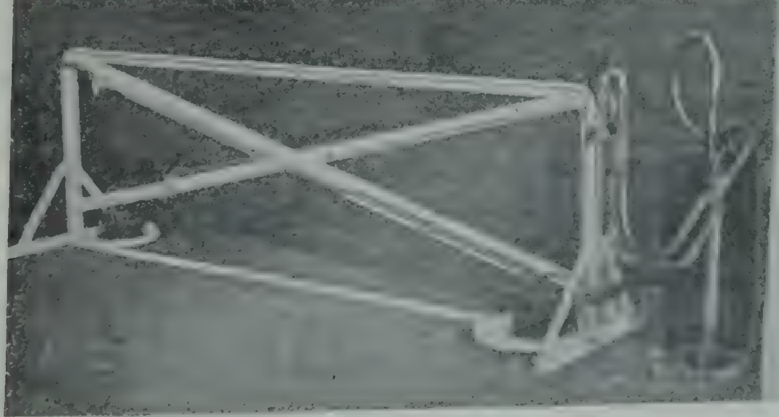


FIG. 118. — Apparatus for determining the amount and composition of air in the soil (Constructed by Prof. A. DOJARENKO).



FIGS. 119 and 120. — Apparatus for determining the interchange of gases, between soil air and atmospheric air, soil respiration. (Constructed by Prof. A. DOJARENKO and A. TROFIMOFF).

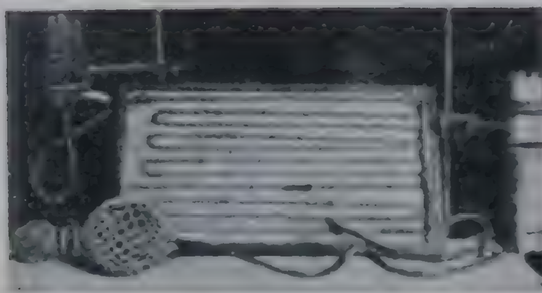


FIG. 121. — Apparatus for determining soil permeability to air. (Constructed by Prof. A. DOJARENKO.)

FIG. [illegible]. — Apparatus for calorimetric determinations. (Constructed by Prof. A. [illegible])

For hygrometric investigations the author has worked out two new methods for determining soil moisture, which though less exact than those usually employed, have the advantage of enabling very rapid determinations over large areas to be made, and at the same time of indicating soil porosity. One of these methods consists in comparing the concentration of an alcohol solution before and after mixing it with a soil sample. The second, the pyknometric method, is based on the comparison of the specific weights of two soil samples of which one is perfectly dry. In the investigation on hygroscopicity the author attributes the greatest importance to soil permeability, soil evaporation capacity and capillary activity, for these three factors may be most easily modified by cultivation.

An apparatus constructed by the author is shown in Fig. 124.

This apparatus, which can be used in the open field, enables the speed of the penetration of water into the soil to be measured at the moment when the imbibition current attains a constant speed, which happens when the soil is completely saturated with water; by it also this measurement can be made at various horizons in the subsoil.

Soil aeration had hitherto been very little studied. The author has made a series of researches on this subject by original methods and by means of an instrument which he invented to determine the air reserves in the soil and their composition. This apparatus is shown in Fig. 118 By it the total air contained in a soil sample may be extracted by aspiration, the natural structure of the soil having remained intact, and afterwards the gases obtained are analysed to determine their oxygen and carbonic acid content. These tests have shown that the quantity of oxygen in the soil is exceedingly variable and that the lack of oxygen may become so pronounced that the failure of crops may often be attributed to this cause. The tests having shown that the oxygen reserves of the soil only suffice for eight days at the most, the interchange of gases between the soil and the atmosphere is necessary for the success of crops. This exchange, considered by the author as a process of soil respiration, is carried out by the diffusion, conversion, and imbibition of water. To measure the extent of these processes the author applies the eudiometric and hydrostatic methods and employs the apparatus shown in Figs. 119 and 120, with which the quantity of air set free and absorbed by the soil may be determined in the open field and thus the soil respiration measured.

The soil's permeability to air depends on its non-capillary interstices which is measured by the manometric method, determining the speed with which the pressure is communicated, or by the potometric method from the speed of the movement of the air-bubbles in the instrument shown in Fig. 121, driving the air through the soil under a determined pressure.

In order to study the atmospheric air and measure the increase of carbonic acid content, an aerodynamic method is employed, by which the composition of the air in these various atmospheric layers may be determined.

Plant nutrition is examined by the calorimetric method, with certain improvements. To obtain soil solutions an emulsion is prepared by mixing the soil sample with the oil, which is afterwards removed by means of a centrifugal apparatus. The solution is then studied to determine: (1) the osmotic pressure, (2) electric conductibility, (3) dissociation by electrolysis, (4) concentration of hydrogen-ions, (5) nutrient substances content and the forms under which they are present.

Soil structure and stability are expressed quantitatively by the relation between the capillary and non-capillary porosity of the soil, which determines the dynamics of every process which takes place in the soil. These two kinds of porosity are measured by the pyknometric method. The stability of the soil structure is measured by means of an apparatus which determines quantitatively the dispersion of the sample in water. The author also carries out tests with a new instrument for taking soil samples at different depths without altering the soil structure.

The biological activity of the soil is also examined by new methods, which are still in course of preparation. The final result of all these investigations is summarised in the last problem examined by the author in his researches on the utilisation of solar energy. In this case the method of actinometric observations is employed for determining the quantity of energy imparted to the fields by solar radiation, and the calorimetric method for estimating the quantity of this energy stored up in the crops; the relation between these two values gives the coefficient of solar energy utilised.

II. The author considers that one of the most important problems is to determine which crops can be made to store up the greatest quantity of solar energy in the form of organic substances utilisable for human consumption, and what methods of cultivation will serve to increase the quantity of energy stored up by each crop. The practical importance of this question will be readily grasped, especially when it is considered that the sun is the primordial generator of all energy on our planet and that the quantity of its energy available is necessarily limited. But before being able to exercise any influence on the quantity of solar energy absorbed by plants, which are the sole collectors of the said energy, the quantitative investigation of the process of its accumulation in the plants is obviously necessary. The author has been engaged on this investigation for about ten years.

The quantity of solar energy available varying for each species of plant according to its structure, the space it occupies, and other factors, the author has chosen 11 species of widely cultivated plants for his researches. For each crop the total radiated energy was ascertained by the actinometric method, and to find that which the plant had stored up, the number of calories in the dry matter were estimated.

This dry matter was reduced to a fine powder and then made into a cake, which was placed in a calorimetric bomb filled with oxygen, on the BERTHELOT-KRAKER-MUELLER system, and complete and instantaneous combustion was caused by an electric spark.

Fig. 122 shows the instruments used for these tests i. e., the press for

making the cake, the calorimetric bomb, the manometer for determining the pressure of oxygen, the two GRENET elements, the water calorimeter with its stirring rod, a thermometer and the lens for taking these readings.

These observations showed that the average number of calories annually radiated over an area of one hectare was 3863 millions.

For the 11 crops examined, the number of calories available varied from a minimum of 1628 millions for lupins to a maximum of 2501 millions for beet. But the number of calories actually accumulated in the various crops was only a maximum of 77.5 millions for the lupins and a minimum of 47.7 millions of calories per ha. for beet. The quantity of calories absorbed is therefore very small as compared with the quantity available; in the tests this proportion varied from a minimum of 1.91 % to a maximum of 4.79 %. This proportion, called by the author *coefficient of utilisation* of the solar energy by plants, is expressed in the following figures for the various crops tested:

Mangels	1.91 %	rye	[illegible]
sugar	1.94 »	wheat	2.68 »
turnips	1.95 »	oats	2.74 »
vetch	1.97 »	flax	3.01 »
clover	2.18 »	lupins	4.79 »

It should be noted that the crops which store up most calories are oleaginous; next come those rich in albumen, while the other substances — starch, sugar and cellulose — only differ from one another slightly from the calorimetric point of view. The diagram shown in Fig. 143 shows the distribution over the 12 months of the year for 4 consecutive years of the calories radiated per ha., the quantity of calories available for each crop (the average for the same years), that which was really absorbed by the plants, and finally the percentage of the corresponding coefficient of utilisation. Two supplementary items of information on rye and wheat are also to be found in this diagram, regarding their absorption of calories during the most intense period of growth, i. e., from the termination of tillering until earing. During this period wheat absorbed 8.78 % of the available calories, and rye, 7.58 %. It will be readily understood, that the plant absorbs different quantities of calories at different phases of growth according to the surface presented by its foliage and the intensity and nature of the vital processes which take place in its organism.

The author therefore distinguishes the coefficient of utilisation calculated on the average during the growth period, which he calls *average technical coefficient*, from the corresponding figure at the moment when the vital processes are most intense, and which he styles *maximum technical coefficient*. Regarding the use of the word "technical" in these denominations it is explained by the author's intention to distinguish, on the one hand, between the energy transformed by the plant into organic matter and thus stored up in the form of calories available for subsequent utilisation, and on the other hand, the quantity (much larger) of energy absorbed by the plant, a part of which is utilised by the different vital processes. The relation of this total energy absorbed by the

plant to that which was available, is named by the author " the *physiological coefficient*".

Now, it must be mentioned that not only the quantities of energy expressed by the physiological coefficient and the maximum technical

FIG [illegible] — Diagram showing utilization of solar energy. The abscissae indicate months of the year and the ordinates the solar energy irradiated per hectare, in millions of calories. The curves indicate the years 1913, 1914, 1916 and 1919.

A = August	E = December	I = April	N = August
B = September	F = January	K = May	O = September.
C = October	G = February	L = June	
D = November	H = March	M = July	

3863 = Average annual solar energy per hectare, [illegible] millions of calories.

I — Average technical coefficients of solar energy utilised, as percentage of energy at disposal of crop. *a* = mangel, *b* = sugar beet, *c* = turnips, *d* = vetch, *e* = clover, *f* = potatoes, *g* = rye, *h* = wheat, *i* = oats, *k* = flax, *l* = lupins.

II — Total energy accumulated during the harvest in calories per hectare.

III. — Total solar energy available for crop during growth period.

IV. — Technical coefficient, maximum 6 ½ %.

α = rye during month of June, β = wheat during June.

Plate LIX.

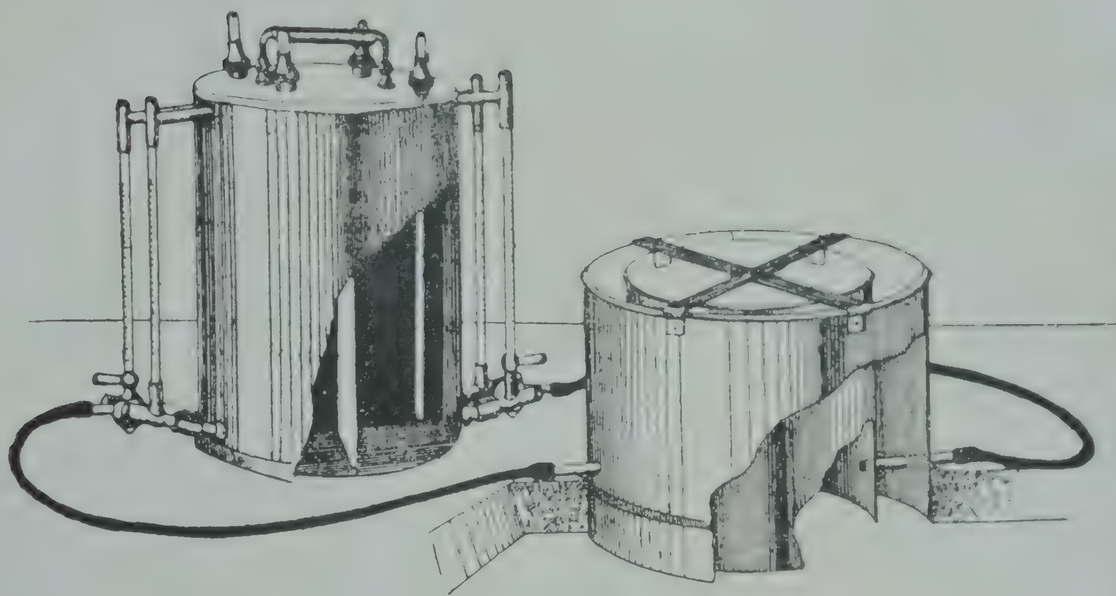


Fig. 124. — Apparatus for determining soil permeability to water (Constructed by Prof. A. Dojarenko).
General view of apparatus with method of supply.

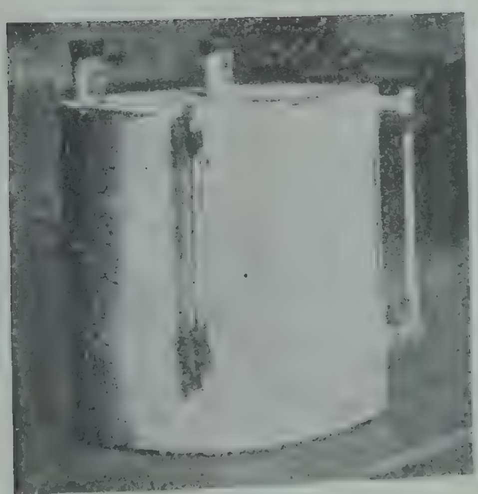


Fig. 125 and 126. - Apparatus for determining soil permeability to water (Constructed by Prof. A. Dojarenko).

External view of apparatus.

Internal arrangement of apparatus.

coefficient, but also those which correspond to the average technical coefficient, are much greater than the quantity which is utilised by the grower in the form of substance or calories. The author's coefficients indeed are calculated on the total dry matter of the plant, contained in its aerial and subterranean parts, whereas the grower only utilises a part of it. To complete the investigation therefore, that portion of accumulated energy which is really utilised by man for each crop, must be determined.

The solution of this question forms the object of the author's present work, which aims at estimating the calories accumulated separately for each part of the plant and for each kind of crop. It is hoped in this new investigation to find the elements for the solution of a practical question of great importance. The great difference between the average and maximum coefficients leads one to suppose that it would be possible to obtain a more complete utilisation of solar energy by means of the mixed cultivation of different kinds of crops which are simultaneously at different stages of growth.

III. — Soil permeability which renders the soil capable of absorbing, distributing and holding water, is certainly an important factor in fertility. A very simple apparatus enabled the author to determine quantitatively, soil permeability by the speed of water imbibition. Fig. 124 shows a general view and the internal arrangement of the apparatus.

As this apparatus can be used in the open field at any required spot, it suffices to remove the upper layers over a small area in order to measure permeability at each horizon. This process has enabled the author to measure the permeability of the arable layer, the podzol and the subsoil. In measuring the permeability of several superimposed layers, the final result obviously depends on the speed of imbibition by the layer which is least permeable ; it suffices to wait until this speed becomes constant.

The experiments have shown that there is always a very close relation between soil fertility and permeability. Thus, a yield of 5.5 lbs. of dry matter per sq. "sazhen" (about 49 sq. feet) in a crop of oats, corresponded to an imbibition speed of 5.5 cubic cm. of water per hour. The figures corresponding to changes of permeability are as follows :

Speed of Imbibition	Yield
—	—
5.5	5.5
6.5	[illegible]
13.06	10.0
37.14	24.75
30.05	[illegible]

According to the experiments, soil permeability depends especially on the lower layers. Indeed it was always possible to impart the desired permeability to the arable layer by cultivation. It is not so much the composition of the soil, however, which determines permeability, as soil structure. Permeability depends much more on the non-capillary interstices than on capillarity properly so-called. Thus the podzol, though

sometimes containing much colloidal matter, may be very permeable if perforated by roots, animals or fissures and crevices of mechanical origin. In these cases deep ploughing may become injurious as by obstructing the orifices of the interstices it decreases permeability. Greater permeability can be imparted to the deep layers of subsoil only by means of drainage, but often mere veins of sand act perfectly as drains, even in the most impermeable clays.

IV. — The author, who worked under the direction of Prof DOJARENKO, on the determination of permeability, gives particulars of the process adopted in these tests. In view of the influence of water on the soil particles, the composition of the water used in the test is not without its importance, and it is recommended that none but rain-water should be used. If the soil shows great permeability, it is not always possible to prolong the experiment until the speed of imbibition becomes constant owing to the great quantity of water which would have to be employed. In this case the permeability can be measured after the apparatus has been working one hour, for then the decreased speed of imbibition always becomes insignificant. In raising the upper layers of the soil care should be taken not to break into the structure of the surface of the layer to be measured, for the obstruction of the orifices of the non-capillary interstices, even though quite superficial, is often sufficient to cause errors in the results of the experiment.

V. — The fact that scientific surface cultivation tends to eliminate useless evaporation is well known, and has been applied in a whole series of methods of cultivation in connection with " dry farming ". Feeling convinced that it was impossible to perfect these methods without carrying them out on a quantitative basis, the author undertook his tests in order to measure the speed of soil evaporation, as compared with that of a surface covered with water. Investigations of this nature had already been made on soil samples in the laboratory, but more convincing tests were made in the open field on soil particles in natural conditions. For these measurements a special instrument was constructed, shown in fig. 127. It is composed of a metal cone without a base, the edges of which are embedded in the soil. The air which penetrates into the cone above the soil passes through tubes, filled with calcium chloride, which dry it within 2.5 mm. of complete saturation. The air is driven into the apparatus by means of a suction ventilator fixed at the end of a tube inserted in the upper section of the cone and containing an ASSMANN phsychrometer. In this way the water evaporated by the surface of the soil was measured and collected by the cone.

The speed of evaporation depends on two factors : in the first place it is determined by the speed of the water's capillary ascension to the surface ; then the true evaporation capacity comes into play and is determined by the extent of the surface. With an equal surface, the soil liberates the same quantity of vapour as a layer of water, if the soil is brought to a state of perfect, and constant saturation. Certainly, under natural conditions the temperature, wind and hygroscopicity of the air also exert an influence on evaporation. But, under similar conditions,

a soil with a perfectly even surface should evaporate less water than a soil with an uneven surface, since the extent of the latter is necessarily greater. Now, the contrary generally takes place in the open field. The reason of this is that by breaking up the arable layer by ploughing, etc.,

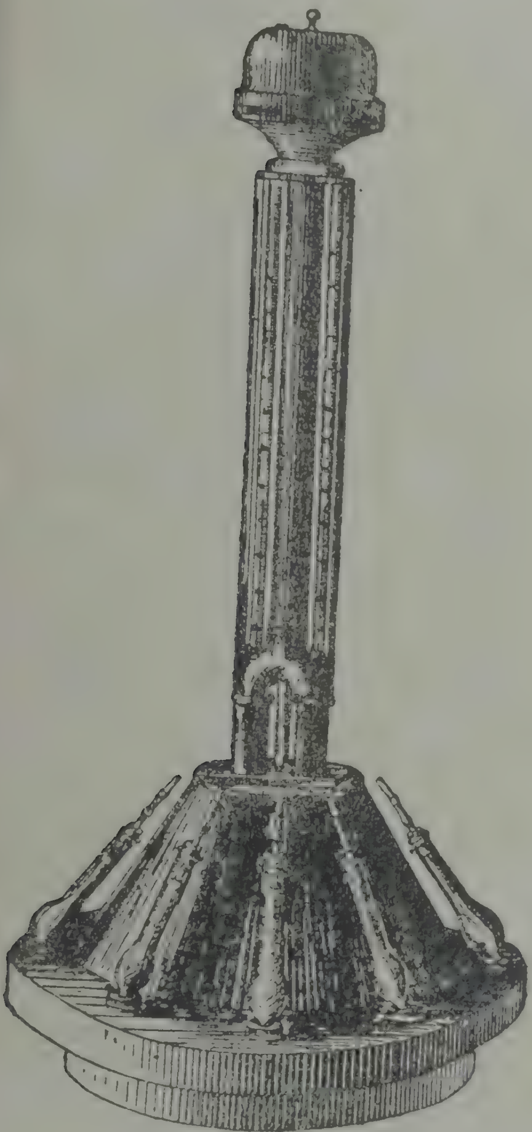


FIG. 127. — Apparatus for determining soil evaporation. (Constructed by Prof. A. DOJHARENKO). General view.

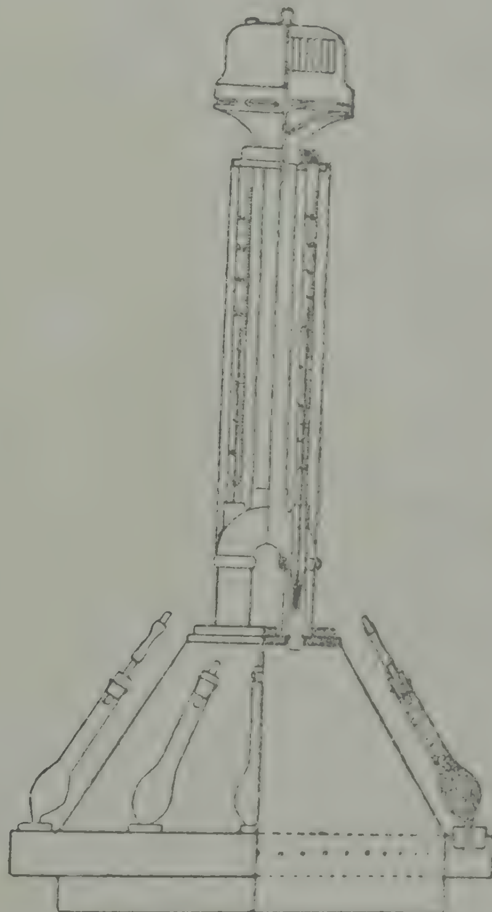


FIG. 128. — Apparatus for determining soil evaporation (Constructed by Prof. A. DOJARENKO) : Section.

the natural structure of the soil is destroyed, in which structure the capillary interstices communicate with one another uninterruptedly up to the surface crust, which facilitates the ascension of the water from the lower layers to the surface. The destruction of this continuity in

the capillary structure therefore explains the efficacity of surface cultivation in preserving the reserve of water in the lower layers.

Cultivation experiments showed that harrowing fallow land in spring decreases evaporation by 20.7 %; ploughing combined with harrowing at the same period decreases evaporation by 50 %; finally, if by continual ploughing the land is kept fallow, without vegetation and well broken up, evaporation is decreased by 59 %; these figures are expressed in comparison with those for evaporation in an uncultivated field.

Further investigations, now being carried out, aim at reducing the results obtained to a constant temperature, which will enable a surface of open water to be used for purposes of comparison, but in order to eliminate the temperature factor methodical investigations are still indispensable.

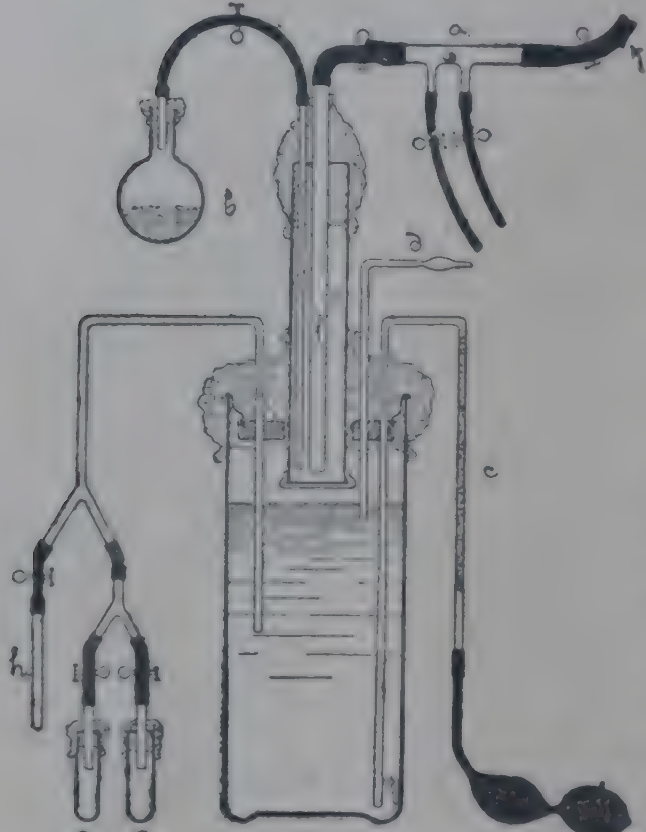


FIG. 129. — Plan of apparatus for determining the absorption of oxygen by plants under sterilised condit ions of cultivation.

VI. — The necessity of aerating the soil and the absorption of oxygen by plant roots are well known facts. It is obvious that the root cells must consume oxygen, like all other living cells. But the tests for determining this process in the roots are generally based on the quantity of carbonic acid given off; it was not taken into consideration that the results thus obtained could not be exact, since the carbonic acid formed might be the result not only of root "respiration", but also of a series of other chemical processes. Also, the methods followed did not enable the requirements of the roots in oxygen to be determined quantitatively.

In order to solve this problem aquatic plants were used, which were supplied with the necessary oxygen by insufflation in the nutrient solution. Similar solutions, subjected to the same treatment, served as controls. Having observed, after a series of tests, that the nitrates contained in the nutrient solutions, became regularly transformed into nitrites also in the control solutions without plants, the author became convinced that the results were affected by the influence of micro-

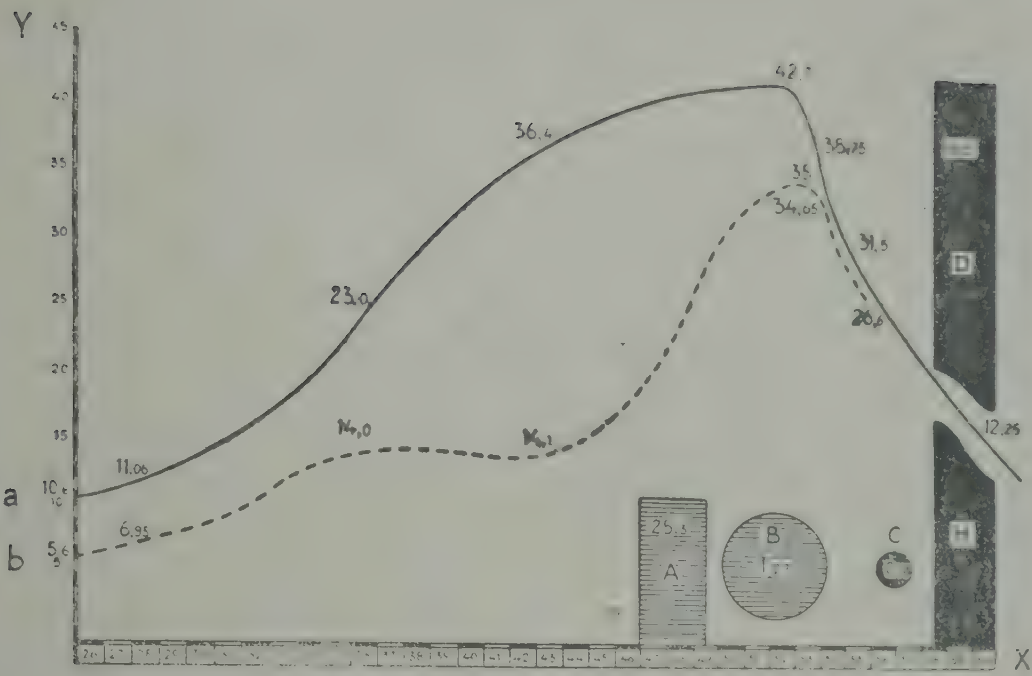


FIG. 130. — Diagram representing absorption of oxygen by plant roots in sterilised culture. The figures on the abscisa show duration of crop in days. The figures on the ordinate indicate the consumption of oxygen in milligrams per gram of dry matter.

The curve *a* relates to maize, curve *b* to peas. The black column shows yield in dry matter for maize D, and the column A the corresponding figures for peas. The circles B and C represent the average daily consumption of oxygen on thousands of grams per gram of dry matter, B for maize and C for peas.

organisms and further work is being carried out on perfectly sterilised plants.

The method applied to these plants, however, being very complicated and requiring extremely careful manipulation, the author was obliged to limit his tests to two species of plants, maize and peas. The apparatus used in these tests is shown in Fig. 129. These tests showed that the roots really consume oxygen in large quantities and that the plants die if their roots are deprived of it. The roots of maize and peas consume 0.38 to 1.37 mgms. of oxygen per gm. of dry matter in 24 hours. The curve expressing the consumption of oxygen attains its maximum during the flowering period (Fig. 130). An insufficient oxygen supply causes the roots to take up this gas from the oxygen compounds in the nutritive solution ; this process causes the formation of nitrous acid NO_2, and the transformation of the nitrates into nitrites ; in spite of this the plants are immediately attacked by chlorosis, for the processes of reduction prevent the absorption of iron by the plants.

Basing on a consumption of oxygen by the roots of 0.38 to 1.43 mgms. per day and per gm. of dry matter, it is estimated that with a good cultivation of a soil giving 50 % of aeration, the arable layer can take up a 10 % supply of oxygen, and that this reserve would only suffice for

10 days with a yield of 1000 puds (161 q.) of dry matter per ha. The presence of a sufficient reserve of air in the soil, however, is not sufficient proof that the total needs of the soil in oxygen will be satisfied, for the composition of the air in the soil is subject to considerable variations. It often does not contain more than 5 to 7 % of oxygen, which quantity is insufficient, as regards the needs of the roots, to carry out those processes of reduction which exert a great influence over the course of the whole biological activity of the soil.

The author is at present engaged on the study of this last problem.

VII. — It has already been long known that the soil nitrates accumulate when the soil lies fallow, and that they continue to increase in quantity until the winter sowings, and then rapidly decrease until they have almost entirely disappeared at the beginning of winter. The causes of this process are also known. They are: the absorption of the nitrates by the plants, the fall of the temperature, increase of humidity, decrease of aeration, variations in the composition of air in the soil and, finally, leaching. It is not proposed for the moment to examine all these processes. The object of the investigation is confined to ascertaining under what forms the nitrogen of the nitrates is extracted from the soil. Is decomposition complete on release of the pure nitrogen, or does this element enter into other organic combinations? The question is not without importance from the practical point of view, for if the nitrogen is released in a pure state it is definitely lost, and cultivation would tend to the systematic exhaustion of the fields. If on the contrary the nitrogen only passes from a mineral to an organic combination, even admitting that the latter is not available for assimilation, it will still be possible to convert it into a utilisable form. Fallowing therefore cannot be condemned *a priori* as a process of cultivation. It is also obvious that the properties of the new organic combinations of nitrogen are of great importance in determining the more or less considerable difficulty there may be in reconstituting the nitrates.

Placed in this light the problem presents itself under a double aspect. On the one hand the combinations of nitrogen in different soil types had to be studied, and on the other hand the dynamics of these combination in the soil, in connection with the progress of the biological processes which take place therein, had to be determined.

The tests for determining the transformation of the nitrogenous compounds were made by means of a fractional hydrolytic operation.

As regards the first part of the problem it was observed that the characters of the nitrogenous compounds are different in different soils; this difference is especially striking if the chernozem be compared with the podzol. In the chernozem the forms assumed by the nitrogen in its combinations are of great stability; the nitrogen is released with difficulty in the extracts, for it has a tendancy to accumulate in combinations which are very resistent to hydrolysis; even after boiling for 15 hours in a 20 % solution of sulphuric acid they do not decompose. The nitrogenous compounds in the podzol, on the contrary, are very unstable, decompose easily under repeated hydrolysis, contain a comparatively

large quantity of nitrogen soluble in acids, and only possess imperceptible quantities of forms which resist hydrolysis. Silt soils occupy an intermediary place between chernozem and podzol in this respect.

These results agree with the empiric indications of practical agriculture. The vital activity of the chernozem should always be aroused by cultivation, whereas in the case of podzol, cultivation tends to confine within certain limits its tendency towards a too strong mineralisation ; nitrification is always more active in this soil, though the actual figures representing the quantity of nitrates formed are eventually higher in chernozem.

To solve the second part of the problem conerning the dynamics of the nitrogenous combinations, the following tests were made : A sample of soil deprived of nitrates was placed in conditions favouring the development of aerobes and afterwards analysed twice, the first time after 30 and the second after 100 days ; then the same sample was placed in anaerobic conditions for 60 days and again analysed. Another sample containing nitrates was subjected to the anaerobic treatment and analysed twice, after 100 and 170 days.

The results show that in both cases the most important factor is the soluble nitrogen in the acids. In the samples placed in aerobic conditions, nitrates formed at the expense of the soluble nitrogen in the acids. In anaerobic conditions the nitrogen of the nitrates is transformed directly into compounds soluble in acids. The chemical processes of these transformations are very complicated, for, besides the soluble forms, other nitrogen combinations take part. In anaerobic conditions the general tendancy is to transform the staple combinations into other forms which decompose easily. In aerobic conditions the process proceeds inversely.

It follows from this that the disappearance of the nitrates in natural field conditions is not attended by a loss in nitrogen. Since anaerobic conditions cause the formation of nitrogen compounds, refractory to transformation, however, the reconstitution of the mineral compounds of nitrogen is necessarily rendered very difficult by the accumulation of these componnds.

G. Z.

564. Plant Production as a Measure of Environment.

WEAVER, J. E. (University of Nebraska). *Journal of Ecology*, Vol. XII, No. 2, pp. 205-237, figs 14, plates 5. Cambridge, 1924.

The most important relation in plant ecology is the reciprocal one existing between the plant itself and its environment. Any attempt to determine exactly the causes which produce modifications in individuals and, consequently, in general growth, must include measurement of all the environmental factors. This must be done by means of instruments of precision, thus furnishing the bases for determining the ratio between the said stimulus. In this way however isolated data, difficult to interpret are obtained, whereas it is necessary to have an integral idea of environment, which can be given only by the living organism, *i. e.* the plant.

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The object of the author's work is to analyse the intricate relations between plant and environment, so as to determine more exactly the effect of varying amounts of factors upon plant response. With this object in view, numerous plots measuring 1 metre square, were selected in typical areas in the climax vegetation. The height and density of vegetation, the abundance of the dominant and subdominant species, etc. were noted. The plants were then cut off level with the ground, air dried and weighed; the resulting datum represents yield. Numerous data, perfectly comparable one with another, have thus been collected, which may show the relative importance of the species predominating under various conditions.

The observations made covered a period of three consecutive years and were carried out in stations considered to be representative of the true prairie (*Stipa-Koeleria*), of the mixed prairie (*Stipa-Bouteloua*) and of the short-grass plains (*Bulbilis-Bouteloua*). At the same time the atmospheric and edaphic-ecological data were collected (rainfall, water and nutrient matter content of the soil, etc.). The yieldof cereals and grasses was also examined.

The most important factors on which yield is dependent are the relations between water on the one hand and soil and air on the other; the other factors are only accessory. The yield of pure stands of short grasses, wheat-grasses (*Agropyrum glaucum*), mixed short and tall grasses, and mixed tall grasses, was found to decrease from the true prairie through mixed prairie to short grass plains in direct relation with the available content of the soil and, inversely with atmospheric evaporation. The same relation was determined for oats, wheat and barley, and also for alfalfa, sweet clover and maize. In general it may be concluded that the wild and cultivated plants integrate the conditions of environment and through yield, express them quantitively. A. F.

565. **Factors Affecting Yield in Tropical Crops.**

I. HARLAND, Prof. S. C. Cacao: some Botanical Problems. *Tropical Agriculture*, Vol. II, No. 3, pp. 65-66. Trinidad, 1925.

II. CHEESEMAN, E. E. Fruitfulness. *Idem.*

I. A striking feature of a cacao plantation is the enormous variation in the yield of the trees, hence the importance to the planters of eliminating poor yielders. The barren trees produce flowers but do not set fruit.

The results of the author's experiments in Trinidad may be summarized as follows:

(1) Observations by the microscope have shown that only about 5 % of flowers ever receive any pollen on their stigmas.

(2) In the case of hand-pollinated flowers there is a setting percentage of 5 % as compared with 0.3 % in flowers not so pollinated.

(3) In the case of flowers visited by ants and aphides about 2 % of setting occurs. The examination of 4500 flowers shows that these insects are important factors in pollination.

Elimination of crawling insects by adhesive bands showed the presence of another pollinating agent, which pollinated about 1 % of flowers.

On certain trees hundreds of flowers were pollinated without one pod being set, whereas on other trees a large number always set. Hence, it is evident that some trees are good setters and unproductive trees are bad setters of fruit. It should be possible to breed a strain of good setters. Certain strains of cotton suffer from shedding of buds, flowers and young fruits, and it hs been possible to isolate strains comparatively free from this defect.

Employing the seed of high bearing trees will not ensure high bearing progeny, owing to natural crossing hence, the value of a tree for seed purposes can only be estimated by taking the average yield of its daughtel trees.

II. Research has shown that the onset of the flowering and fruiting stages in plants is probably determined by the relative proportions of carbohydrates and nitrogenous substances in the tissues, or by some factor connected with the carbohydrate-nitrogen ratio. This ratio is in turn dependent upon the plants' constitution, nitrate supply, area of green surface exposed by the plant, and the relative lengths of day and night throughout its life history.

W. S. G.

566. **Influence of the Duration of Light on Growth.**

ADAMS, J. (Central Experimental Farm, Ottawa). *Annals of Botany*, Vol. XXXVIII, No. CLI, pp. 509-523. London, 1924.

The author has tested 16 different species of plants, including wheat, rye, hemp, soy, the tomato, buckwheat, etc. Some of the plants were grown in the dark, others were exposed to the light for periods varying from 3 to 15 hours per day, others again were also exposed to artificial light, the total exposure being 20 hours per day.

At first growth followed more quickly in those exposed for a shorter period, but in the end the plants exposed for a longer period attained a greater altitude. It is concluded from this that growth, both in the light and in the dark, depends on the supply of reserve matter available for the formation of new tissues, and that, if two plants have the same quanity of this matter, that which is exposed to the light for a shorter period will grow more rapidly while the supplies last.

Plants which grow with less light are deficient in mechanical tissue and tend to droop, while the soy tends to become rampant; under these conditions the plants generally remain without branches.

The influence of electric light varies. From December to March (average period of light 9-12 hours), a further 9 hours' exposure at night with a lamp of 100 to 300 watts has a beneficial influence, fostering growth and hastening on the flowering period. From March to June, with more than 12 hours' light daily, the addition of a further 5-6 hours' artificial light has the greatest effect on buckwheat, whereas it does not hasten on the flowering period of spring wheat and the tomato, and retards that of soy, and hinders the attainment of height and weight by hemp. It seems that for the last-mentioned plants, the quantity of light which can be utilised by the plant is very limited, and that beyond this limit no further growth takes place.

A. P.

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567. **Acidity Changes during the Growth Period of Wheat with Reference to Stem-Rust Resistance.**

HURD, A. M. (Bureau of Plant Industry, United States Department of Agriculture). *Journal of Agricultural Research*, Vol. XXVII, No. 10, pp. 725-735, figs. 5, bibl. Washington, D. C., 1924.

The titratable acidity of the juice of the wheat plant undergoes a series of changes dring the growth of the plant from the seedling stage to that of maturity. There is a progressive decrease, to about a half, of the initial concentration, during the period of life beginning after the first fortnight and continuing until the expiration of 6 weeks. This period is followed by another of comparatively low acidity, with minor variations, which continues until the approach of maturity; after which acid concentration increases until maturity and drying. The final acid value may be double the seedling concentration and three time that of the period of owest acidity.

The hydrogen-ion concentration of the juice does not decrease appreciably between the ages of 2-6 weeks. It increases greatly during the period preceeding maturity and attains a comparatively high value at flowering and later.

The increased concentration of acidity during the last stages is connected with the decrease of water rather than the formation of seeds.

Titratable acidity and hydrogen-ion concentration are influenced by environmental conditions, which however vary very little as compared with the changes brought about by the growth stages of the plant, so that the general trend of acidity curve persists under all conditions.

Stunted plants are characterised by high acidity and hydrogen-ion concentration; the intermediate period of low acidity may not occur at all in them. Mildew infection also, when serious enough to show its influence on the plant, causes abnormally high acidity.

The high acidity of the juice does not prevent attacks of rust, while, on the other hand, low acidity does not predispose to this disease since the plant is not more liable to infection in one period than in the other. The resistent varieties pass through the same variations of acidity without thereby becoming less resistent. A. F.

568. **The Irritant Action of various Chemical Products and its Effect on the Germination of Potato Tubers.**

LOHMANN, J. (Institut für Pflanzenbau und Pflanzenzüchtung der Universität, Breslau), Reizwirkungen chemischer Verbindungen auf die Keimung der Kartoffelknollen. *Landwirtschaftliche Jahrbücher*, Vol LXI, part I, pp. 1-44, bibl. Berlin, 1925.

The irritant action consists in a deviation of the normal course of vital activity caused by the influence of an external factor on the internal mechanism of the growing organism whereby a reaction of the organism itself is set up.

The favourable influence on the germination of the potato exercised by oxygen, ether and hot air, and the unfavourable influence of substances

containing copper, is to be interpreted in this sense; the injurious action of ferric sulphate on the other hand must be considered as a consequence of plasmolysis.

The influence of colloidal sulphur and "Uspulun" (a product with a chlorophenolate of mercury base, which shows evident influence on the *Rhizoctonia*) is doubtful. Sulphates and chlorides, in moderate quantity, may have a favourable influence on germination, but in larger quantities become injurious. In general however the duration of the contact has a greater influence than the concentration of the solutions, and this is so to such an extent that keeping the tubes in water for a certain time is sufficient to lower their germinative vigour.

Colloidal sulphur, hot-air treatment and Uspulun will perhaps be applied in practice; the last-named acts especially in a powdered form rather than in solution; it however injures the tubers if applied after germination has begun.

A. F.

569. **Effect of Nitrate Application upon the Hydrocyanic-Acid Content of Sorghum.**

PINCKNEY, R. M. (Minnesota Agricultural Experiment Station). *Journal of Agricultural Research*, Vol. XXVII, No. 10, pp. 171-723, Washington, D. C., 1924.

The percentage of hydrocyanic-acid in green plants is in direct proportion to the nitrate used; the effects of the latter on the hydrodyanic-acid content continue after it has no longer any influence on the colour and size of the plant. In sorghum plants which are but slightly coloured, yellow or greenish-yellow, the hydrocyanic-acid is present in very small quantities or entirely absent, whereas in deep green plants it is present in quantities which are easy to determine; in such plants the hydrocyanic-acid is equally distributed in the stem and leaves.

Sorghum is thus a good indicator as to the presence of readily available nitrogen in the soil; it promptly responds not only by rapid growth and dark colouring, but also by a high hydrocyanic-acid content, which is higher in young plants. Only a few plants are required for an analysis, which may be made a few weeks after sowing.

A. F.

570. **Substances Similar to Insulin Eztracted from Plants.**

GLASER, E. and WITTNER, L. (Chemisches Laboratorium des pharmakognostischen Instituts der Univ. Wien). Ueber die blutzuckerherabsetzende Wirkung von Pflanzenextrakten und Oxidasen sowie den Nachweis von Fermenten im Insulin. *Biochemische Zeitschrift*, Vol. CLI, No. 3-4, pp. 278-295. bibl. Berlin, 1924.

Substances possessing, like insulin, the power of decreasing sugar in the blood, may be axtracted from fungi and turnips. As however by the methods used for extracting such substances, the ferments may also be extracted, the authors extracted these latter (peroxidases and catalases)

and observed that they have a marked influence in decreasing sugar in the blood, and that the purer they are the greater this influence.

But in insulin, ferments are to be found, such as peroxidases, some of which act in a contrary manner. The decrease of sugar in the blood may therefore perhaps be due to the action of such ferments. Their effect, like that of insulin, is destroyed by mineral acids and by tryptic digestion. A. F.

571. Absorption of Urea by Fungi.

IVANOFF, N. N. (Institute of Plant Physiology, Petrograd University). Die absorption des Harnstoffes durch Pilze. *Biologische Zeitschrift*, Vol CL, Nos. 1-2, pp. 115-122. Berlin, 1924.

Fungi absorb the urea of the respective solutions and accumulate it up to 14.0 % of the dry weight of the pileus. The accumulation is more evident in the hymenium of the receptacle, where the spores are formed.

The thio-urea is also absorbed by the receptacle, but only by a further treatment, since, if urea be added to the thio-urea solution, only the urea is absorbed.

The *Bolbitius vitellinus*, which contains urease, does not accumulate urea because the latter is quickly decomposed by the urease, whereas on the other hand this fungus can accumulate thio-urea, on which urease has no influence. A. F.

572. The Function of Nicotine in the Tobacco Plant.

THERON, J. J. and CUTLER, J. V. (School of Agriculture, Potchesftroom). *South African Journal of Science*, Vol. XXI, pp. 189-194, tables 4, figs. 2. Cape Town, 1924.

Alkaloids have been described as excretory or waste plant products, protective agents and storage products. Notwithstanding the poisonous character of nicotine to the animal organism, it fails to protect the tobacco plant against the attacks of eelworms, aphides and bacteria. The authors are of opinion that nicotine is stored in the plant as a nitrogenous food, and is not merely a waste product or a protective agent. Their investigations enabled the following conclusions to be drawn:

The total nicotine per acre and the percentage per plant increase up to the flowering stage, after which there is a rapid decrease. The formation of seed has the immediate effect of reducing the percentage of nicotine per plant. If seed formation be prevented nicotine tends to increase, rather than decrease. In order to effect an increase both in the yield of nicotine per acre and the percentage per plant, the crop must be manured with phosphatic and potassic fertilisers, in addition to nitrogenous fertilisers.

The importance to the grower of these facts is that, whenever tobacco is grown for nicotine, the life processes of the plant should be interrupted as soon as possible after the stage is reached where the plant contains the maximum amount of nicotine. Unless the plant be killed as soon as possible after harvesting, there is a decline in nicotine content. On the

other hand, smoking tobacco should be so treated that the plant organism itself removes any excess of nicotine that may be present in the leaves.

W. S. G.

573. The Presence of Substances similar to Insulin in Beans.

EISLER, M. and PORTHEIM, L. (Staat. serotherap. Institut und Biolog. Versuchsanstalt der Akad. der Wissensch. in Wien). Ueber insulinartige Stoffe aus Bohnen und deren Wirkung auf den Kohlenhydratstoffwechsel. *Biochemische Zeitscjrift*, Vol. CXLVIII, Nos. 5-6, pp. 566-572. Berlin, 1924.

The authors have isolated from an extract of beans (*Ph. multiflorus* and *Ph. vulgaris*) an alcoholic precipitate which, like insulin preparations, contains an active principle capable, of diminishing the sugar in the blood of rabbits, of accelerating the scission of the starch and favouring diastatic fermentation.

The pure extract also has the property of reducing the sugar in the blood, but has an obstructive influence on the enzymes. This influence may probably be attributed to those portions which are soluble in alcohol.

A. F.

Plant Breeding and Seeds.

574. A Programme of Maize Improvement.

WOODWORTH C. M. *University of Illinois, Agricultural Circular* No. 284, pp. 24, figs. 12 Urbana, Ill., U. S. A., 1924.

The author draws attention to the need of improvement in maize breeding and in this Circular gives suggestions for the production of better strains. Two methods of improvement are given, selection, and the pure-line methods. The characteristic of good seed areas are stated and illustrated by photographic reproductions.

The importance is emphasised of co-operation between the Experiment Station, the plant breeder, the seed producer and the maize grower.

W. S. G.

575. Comparative Tests of Six Philippine Maize Varieties.

MARQUEZ, F. D. *Philippine Agricultural Review*, Vol. VII, No. 3, pp. 195-201, tables 3. Manila, 1924.

The comparative tests of varieties of native maize were made by the author from 1919 to 1921. The varieties compared were: Bohol White Flint, Cebu White Flint, Moro White Flint, Baluga Yellow Flint, Cazayan Yellow Flint, Calamba Yellow Flint.

The Baluga Yellow Flint was the highest yielder and gave during three seasons, 31.38, 41.65 and 27.57 cavans shelled maize per hectare, respectively (1 cavan of maize = 0.585 q.). This variety was uniform and early maturing.

Baluga Yellow and Cebu White did best during the dry season. Calamba Yellow was a good wet season variety. Moro White was least susceptible to soft-rot disease and stalk and ear-bororers, while Cebu White was most susceptible.

W. S. G.

576. **Machine Winnowing of Paddy Seed.**

Bulletin Economique de l'Indochine. Triage mécanique des semences de paddy. Year XXVII, VI, No. 169, pp. 621-638. 1924.

With a view to improving rice crops in Indo China the "Société française des Distilleries de l' Indochine" have undertaken tests in machine winnowing of seed in their rice plantations at Hanoi. The Company, by placing their material at the service of the rice growers anxious to improve their seed, hope to arrive at useful results. The tests made are encouraging, and they are being continued. The Government of Cochinchina intends to furnish that country with a set of machines similar to those used at Hanoi. *Corr. Indo-China.*

577. **The Effect of Dry Heat on Alfalfa Seed and its Adulturants.**

STAKER E. V. *Journal of the American Society of Agronomy*, Vol. VII, No. 1, pp. 32-40, tables 5, bibliography. Geneva, N. Y., 1925.

The author's investigations were carried out on various seeds heated in soil, water, in atmospheres of different humidities, carbon dioxide, ether, carbon disulphide, and dry air; the present article, however, deals only with the effects of dry heat on seeds.

The investigations indicate that heating commercial alfalfa seed at temperatures from 60° to 90° C., increased the percentage of germination, 60° being as effective as 90° C. The increase was attributed to reduction in the number of hard seeds. Light green or yellow seed is more responsive to heat than brown seed. Russian thistle and white tumbleweed seeds were killed when heated for four hours at 85° to 90° C., and seeds of dock and buckthorn were injured.

The author is of opinion that dodder can be controlled by heating alfalfa containing dodder seed to a temperature of 85° to 90° C. for four hours, but furher experiments are necessary before this can be confirmed.

W. S. G.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES

Cereals, Roots and Forage Crops

578. **The Manuring of Grass Land for Hay at Rothamsted.**

SMITH, Dr. W. G. *The Scottish Journal of Agriculture*, Vol. VII, No. 3, pp. 257-264. Edinburgh, 1924.

These experiments were started in 1856 and have been carried on continuously.

The conclusions to be drawn from these experiments are too numerous to be brieflly summarised, but the following are of special importance:

It is unprofitable to leave enclosed grassland unmanured. The foundation of grassland manuring is phosphates and to some extent potash, which alone will produce good grazing land, although they do not encourage the bulkier grasses that give hay. High yields of hay are obtained by the application of 4 to 6 cwt. per acre of sulphate of ammonia or 2 ½ to 5 cwt. of nitrate of soda, but these do not favour good grazing, as the growth of rank grass injures the bottom grasses. Half the quantities would better suit the grazing herbage.

Bent grass (*Agrostis vulgaris*) increases with starvation and farmyard manure, and is decreased by superphosphate and by lime. Yorkshire fog (*Holcus lanatus*) is indicative of one-sided nitrogenous manuring, or lack of potash. Sweet vernal grass (*Anthoxanthum odoratum*) is encouraged by ammonium salts. Foxtail (*Alopecurus pratensis*) responds to good manuring if lime is maintained. The chief leguminous plant, yellow vetchling (*Lathyrus pratensis*), is reduced by starvation or nitrogenous manuring.

W. S. G.

579. **Silani, a new Cover and Forage Crop.**

HARLAND, Prof. S. C. *Tropical Agriculture* ,Vol. II, p. 74, No. 4. Trinidad, 1925.

Vigna Marina, M., known in the Philippines as Silani, is a perennial plant with yellow flowers and small pods of 4 to 7 cm. in length. Seeds are produced sparingly, but the plant may easily be propagated from cuttings.

Silani cut as green forage is readily eaten by animals, and also forms a good leguminous cover crop. The plant does not tolerate well a long dry season.

Planting should be done during the rainy season, using cuttings about 60 cm. in length. When established the growth is rapid and vigorous.

W. S. G.

580. **Rain Grown Cotton and Climate.**

CANNEY, E. E. (British Cotton Research Association). *Journal of the Textile Institute*, Vol. XV, No. 12, pp. 533-542, maps 3, bibliography. Manchester, 1924.

The main supplies of short staple cotton of the American types have always been grown under rainfall conditions and in studying extensions of the cultivation of these types, without irrigation, climate is the most important factor, as cultivation, drainage, labour, transport, etc., can all be controlled by human agency, which is not the case as regards climate.

The author discusses suitable climatic conditions for a rainfall crop of cotton and suggests that excessive rainfall, cloudiness and insufficiency of sunshine during the maturation period must be as closely studied as water supply and temperature. Special attention is drawn to the necessity for abundant sunshine and to the detrimental effect of overcast skies. As

cloud condition does not always coincide with the amount of rain, rainfall data alone are not sufficient.

The meteorological limits to successful cotton-growing are assumed to be as follows:

(1) A mean annual temperature of at least 60° F., or where rainfall, sunshine and temperature are very favourable, over 5[illegible]° F.

(2) A minimum annual rainfall of 20 inches, with a maximum of 60 inches, rising perhaps to 75 inches if very favourably situated.

(3) areas recording « half-cloudiness » annually are assumed to have insufficient sunshine, and those with « three-fifths cloudiness » to be very unsuitable.

Three maps are appended to the article: (1) shows areas unfavourable from various causes and emphasises the fact that the Tropics are not favoured with such clear skies as is often supposed; (2) shows the areas remaining after eliminating those with two inhibiting factors; (3) is an altitude correction map and shows what allowances must be made for altitude in different latitudes.

A study of these maps reveals the following features:

The well established cotton fields lie in the minimum cloud zones, *i. e.* generally between 10° and 35° N. and 12° and 35° S. The cotton-belts of the United States, India, etc., almost exactly coincide with the climatic limits outlined on the maps. As regards areas where cotton has been tried and failed, it is indicated that the real cause of failure was due to cloudiness or mists, with the attendant humidity and coolness. Cotton growers should avoid such areas.

These maps indicate that, without increases in present yields per acre, there is enough land with suitable climatic conditions awaiting development to grow sufficient cotton for many generations. The most promising regions would appear to be the Argentine, Uruguay, Paraguay and S. Brazil. Within the British Empire, assuming that the cloudiness hypothesis is justified, there seems to be good reason for further study of the following areas: Sierra Leone, the Southern Province of Nigeria, almost all the Gold Coast and Togoland, Tanganyika, Nyasaland, Kenya (except the N.W.), and Uganda. The coastal regions of Natal and most of N.E. Rhodesia, S. Ceylon, Malaya, all the British East Indian Islands. The N.E. coastal strip of Queensland. British Honduras, British Guiana, Jamaica and certain smaller West Indian islands. The most promising regions within the Empire for rain-grown cotton, appear to be S. Sudan, N. Nigeria, the valleys of the Limpopo and Zambesi, S. Africa and the 200-mile strip of coast on the east and north of Australia. The most important of these territories border on areas deficient in rainfall, hence their chief problem will be that of sufficiency of rainfall.

The suggestion put forward by the author that cloudiness is a very important factor in cotton production, while limiting the outlook from one point of view, indicates from a study of the subject and the maps that the acreage in suitable climates is probably at least as large again as the present acreage under rainfall cotton.

W. S. G.

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581. Cotton-Growing in Eritrea.

CARAVAGLIA, A. C. (Istituto Agricolo Coloniale italiano). Il Cotone in Eritrea. *Bollettino di informazioni economiche del Ministero delle Colonie.* Year XII, No. 1, pp. 56-61. Rome, 1924.

Cotton has been grown in Eritrea for many years, but active work there dates only from 1902. After the first trials, which gave encouraging results, the "Society for Cotton-Growing in Eritrea" was founded, and, basing on results from Egyption varieties grown in favourable soils, in 1904 this Society undertook to place the crop on an industrial footing, but was faced with difficulties which caused failure. An adaptable American variety (Allen's Improved) having been found after some years, the problem seemed to be solved, but, after a yield of 12,000 quintals in 1912, production fell owing to various causes, not all dependent on the programme drawn up by the Society. At present the whole of Eritrea produces less than 2000 quintals of seed cotton, of which about 1000 are produced in the western lowlands and 1000 on the table-land and in Zula.

In Eritrea cotton-growing is possible between sea-level and a height of 1800 metres.

Crops are distinguished as follows: those which utilise the rains alone and which are generally arboreal; herbaceous or annual plants, the growth of which is helped by the muddy waters carried down by the torrents during the season of heavy rains.

The arboreal plants may be profitably cultivated in clay soils receiving the summer rainfall: the varieties, methods of cultivation and yield, vary in the table-lands above 950 metres as compared with the mountain districts. In the table-lands, at the beginning of the rainy season, after having cleared the soil of dry grasses by burning, sowing is done without any previous ploughing, 8 to 10 seeds being placed in open holes in the ground. The cotton plant springs up and grows during the continuation of the rainy season and gives a sufficient yield the first year to cover the expenses of sowing, tillage, etc. In the second year, after the first rains, the shrub grows rapidly, giving a yield similar in quality to that of the first year, but much better as regards quantity. In the third year production falls off greatly and the quality degenerates. In the mountain districts, up to a height of 1800 metres, the natives grow cotton for the first two years in conjunction with other crops, afterwards leaving it to grow alone for another 3 or 4 years.

The herbaceous or annual crops are grown in the lowlands in the east and west. The scarcity of rains in these districts may be compensated for by the muddy waters of the torrents, such as the Gax and Barca; this muddy water may be utilised: by irrigation; by means of underground reservoirs; by flooding or inundating. The last two methods are preferable owing to the fact that they deposit on the soil the very fertile silt which the torrents bring down. In the flooded soils, sowing should be done after what is considered to be the last flood, and is generally begun in the higher grounds which have benefitted, during the second part of September.

[581]

The plant grows, and the pod begins to ripen at the beginning of January and continues until the end of March.

The variety now grown is that known as *Carhaut*, which may be considered to be a local variety produced from the Allen's Improved.

A. C. M.

582. The Quality of Ratooned Queensland Cotton.

SUMMERS, F. (British Cotton Industry Research Association). *Journal of the Textile Institute*, Vol. XV, No. 12, pp. 543-546. Manchester, 1924.

The advantages and disadvantages of ratooning are discussed and a comparison is made between a sample of Queensland cotton grown from seed, and a sample grown under the same conditions from plants which had been ratooned at the end of the previous season. In the case investigated, the conclusion drawn is that, the quality of the ratooned cotton is inferior to that of the usual, first-year product.

A decrease of over 6 % was found in the mean staple length of the ratooned sample, and the staple was found to be more uniformly long in the annual. The hair weight per centimetre was significantly less in the ratooned sample, corresponding with the smaller wall thickness, but there was no apparent difference in the degree of convolution of the two samples.

With the exception of a slight increase of strength on mercerisation, the comparison is entirely against the ratooned sample. If further experiments show that ratooning does not give an increased yield, as was the result of experiments made in South Africa, there appears to be little in favour of the practice from an agricultural point of view, and nothing at all from the point of view of plant sanitation.

It is not suggested, however, that ratooning should be condemned without more evidence from other parts of the world, as the above results are true only for the particular Queensland samples under discussion.

W. S. G.

583. Possibility of Creating a Flax Industry in South Africa.

BAKER, E. *Journal of the Department of Agriculture, Union of South Africa*, Vol. X, No. 2, pp. 110-125. Pretoria, 1925.

The article is a general review of the position of the flax industry, the author having visited Europe in 1924 to study the question. General items of botanical and of cultural interest are omitted, as these can be found in text books. Certain ideas bearing directly on crop improvements, as also economic methods of factory management are dealt with, as they are of value to the farmer in deciding whether he can make a profit on growing the crop, and if the factory side of the problem can be worked satisfactorily.

Allusion is made to the work of the Linen Research Association in Northern Ireland, in the establishment of pure lines of improved flax.

W. S. G.

584. **Sisal Hemp.**

JACK, R. W., BISHOP, R. O. and MILSUM, J. M. *Malayan Agricultural Journal*, Vol. XII, No. 11, pp. 352-370, plates 2. Kuala Lumpur, 1924.

The object of the article is to draw attention to the industrial possibilities of sisal (*Agave sisalana*, Perrine) in Malaya, as the work of the Department of Agriculture has shown that it can be grown successfully under local conditions. The information in the paper is equally applicable to any tropical or semitropical country suitable for the crop. The authors discuss the plant under the following heads: climate, habitat, botanical, diseases (practically unknown), soils, propagation, planting, harvesting, preparation of fibre, yield of fibre, quality, cost of production, supply, demand and prices, utilisation of sisal refuse. W. S. G.

585. **Henequen Fibre or Mexican Sisal Hemp.**

Bulletin of the Imperial Institute, Vol. XXIII, No. 1, pp. 4-8. London, 1925.

The article gives an account of Agave, the henequen plant, from the time of the first attempt to produce the fibre on a large scale in Yucatan, in 1830, to the present day. The following sections are discussed, in addition to an historical account: the plant and its varieties, climate and soil, cultivation, pests, harvesting, extraction of fibre, cost of production, export, and in an appendix are given factors relative to the total expenses incurred in henequen production. W. S. G.

Tropical and Sub-Tropical Industrial Plants.

586. **Continuous Growth of Java Indigo in Pusa Soil.**

HOWARD, A. (Imperial Economic Botanist) and HOWARD, G. L. C. (Second Imperial Botanist). *The Agricultural Journal of India*, Vol. XIX, Part. 4, pp. 607-612. Calcutta and London, 1924.

Evidence has been brought forward of phosphatic depletion in the soils of North Bihar. Direct field trials with superphosphate gave no definite results.

The authors in 1919 started an experiment in which Java indigo was grown continuously in a lysimeter having an area of one-thousandth of an acre and a soil-depth of 18.5 inches. No phosphate was added at any time, hence, if the limiting factor was depletion of phosphate, the crop would show progressive diminution in yield.

No change in growth of the indigo was observed until 1922, a year of heavy rainfall, when signs of nitrogen starvation became evident. The addition of sulphate of ammonia, and some sugar to assist the nitrogen-fixing bacteria, soon restored the growth and improved the soil texture.

Although the soil had no rest, and no rotation was practised, the yields were higher than many of those obtained on indigo estates.

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The results do not indicate that Pusa soil is deficient in phosphate. The only soil deficiency observed in this experiment was loss of permeability, followed closely by want of combined nitrogen. The difficulty of permeability of the soil was somewhat of a surprise as the soil was above the average in porosity and good drainage was provided in the lysimeter. Loss of permeability is a serious factor in the rains and the soil assumes a wet, jelly-like condition, well-known to cultivators, under which conditions the indigo plant reacts rapidly. The loss of permeability is probably due to the formation of colloids and it is possible that the addition of substances such as sulphur, which produce dilute acid on oxidation would prevent the formation of these colloids. Preliminary experiments with sulphur and dilute sulphuric acid increased growth during the rains, and acted on the indigo plants like dressings of nitrogenous manure.

W. S. G.

587. **Studies in Jelutong.**

GREENSTREET, V. R. *The Malayan Agricultural Journal*, Vol. XIII, N. 10, pp. 1-8, tables IX. Kuala Lumpur, 1925.

The production of jelutong in the Malay States has increased from 100 pikuls (1 pikul = 133 lb.) in 1922 to 2000 pikuls in 1923, most of the product going to the United States, where it is used in the manufacture of chewing gun.

Jelutong is regarded as an oxidation product of caoutchouc, and analysis has shown its composition to correspond to $C_{25}H_{40}O$.

The author states that condizions in the Malay States are favourable for the production of jelutong. Various methods of coagulation and refining of jelutong latex are described. The characteristics and defects of jelutong prepared in different ways are discussed under the headings: rate of drying; resinification; development of mould. W. S. G.

588. **A Comparison of the Yields of Beets in Czecho-Slovakia.**

Bericht über die vom Zentralverein der tscheslovakischen Zuckerindustrie im Jahre 1924 veranstalteten vergleichenden Versuche mit Zuckerrübensamen (Berichte des Forschungs Institutes der csl. Zuckerindustrie). *Zeitschrift für die Zuckerindustrie der cechoslovakischen Republik*, Year XLIX, No. 24, pp. 179-183. Prague, 1925.

The new varieties examined may be classified as follows.

Sugar Content Percentage: I) Zapotil I (19.40), Dippe WI (19.38), Dobrovice (19.30), Mandelik (19.36), Dobrovice (19.24) — II) Zapotil (19.13) — III) Kleinwanzleben (18.92), Schreiber SS (18.92).

Weight of yield — kg per hectare: I) Kleinwanzleben (368.6), Zapotil II (367.0), Dobrovice (363.6), Hörning (363.2). — Schreiber SS (361.8), Zapotil I (359.0). — II) — Dippe (354.6). — III) Mandelik (338.5).

Sugar production — kg per hectare: I) Dobrovice (70.0), Zapotil II (70.0), Zapotil I (69.0), Dippe (68.8), Schreiber (68.4), Hörning (68.1) — II) Mandelik (65.7). A. F.

589. **Tea Nurseries.**

COOPER, H. R. *Journal of the Indian Tea Association*, Part. III, pp. 150-167, figs. 4. Calcutta, 1924.

In planting out a tea garden the important consideration is the production of healthy young plants, for which a good nursery is essential. The author's notes on nursery planning are based upon personal experience.

Moisture: The most important factor is moisture, and rain is better than watering by hand, as the latter method does not produce a moist atmosphere.

Shade: A moist soil and moist atmosphre are both maintained by shade, which may be satisfactorily produced by a very thin thatch, supported by a frame-work at a height of 5 feet or more from the ground. Such a shade often renders watering unnecessary, except just after planting. The shade should be retained for the whole of the year, the thatch being gradually removed.

Soil Factors: A good sandy loam is best, but seedlings will grow on a clay soil if the texture is good.

Manuring: An application of potash is generally of value, but of more importance is the physical condition of the soil. Texture is improved by cattle manure, but the drawback to this is that it carries so many weed seeds. A green crop may serve the same purpose as cattle manure, if hoed in at least two months before sowing the seed. As a source of nitrogen liquid manure is excellent, but is troublesome to apply; a dressing of 2 cwt. of nitrate of soda per acre gives very good results if applied when the plants are about 4 in. high.

Burning: The soil is greatly improved temporarily, by heat; the greatest effect is obtained by heating just before sowing, and the best method is to spread rubbish on the surface of the soil and burn it *in situ*, as the soil benefits both by the heat and the ash. Heating the soil by means of boiling water alone has given good results.

Preparation of Land: The depth to which it is advisable to dig the land varies with the soil, but the author has obtained the best results by working to a depth of 9 to 10 inches. All kinds of jungle growth, grasses and weeds must be carefully removed from nursery soil.

Drainage: The usual practice is to make up nursery beds about 6 feet wide, with ditches 1 foot in width between, which serve as paths between the beds.

Planting Distance: At Borbhetta (Assam) good results are obtained by triangular planting at a spacing of 8 × 8 inches, but the age at which seedlings are to be transferred must be taken into account; the above spacing is for 12 months plants; for 24 months plants 10 × 10 inches is recommended.

Germination: On the outside of the hard shell of the seed is a scar, usually called the "eye"; seed should be planted with the eye down, as the young plant will then be in the correct position for growth and the root will not have to bend round the seed.

Depth of planting: Seed must not be planted to deeply; half an inch

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of soil should be fine and loose. Immediately after planting the soil should be well soaked with water, after which, if well shaded, very little more water will be needed. It is essential that tea seed should be fresh.

Cultivation : The first weeding should be done by hand ; afterwards, a Planet Junior Two-wheel Hand-cultivator may be used. On this hoe the wheels are connected by a hoop which goes over the line of young plants.

W. S. G.

590. Cultivation of the Tea Plant at Tranninh (Haut-Laos).

DU PASQUIER, R. Le théier et sa culture au Tranninh. *Bulletin économique de l'Indochine*, Year XXVIII, No. 169, pp. 605-619, separate maps and plates. Hanoi, 1924.

The author, tea and coffee specialist at the Agricultural Station at Phu-tho, Tonkin, was entrusted with the work of studying wild tea-plants and the possibilities of growing tea at Tranninh (Haut-Laos, French Indo-China). The present note constitutes his report on this work.

Tea plantations were formerly more numerous and important than they are to-day in this high region. The natives, by excessive exploitation, must have caused the disappearance of several plantations and have, in any case, greatly reduced the number of plants of which they are composed. The only tea-plants still existing in the regions inhabited by the Laotians are those of Muongthane ; the others are scattered in small plantations in the mountain groups which were, before the immigration of the Meos (1), covered with virgin forest and uninhabited. They are therefore quite wild and not, as is the case with the tea-plants in the forests of Central Tonkin, sprung from ancient plantations belonging to villages which have disappeared.

The species of tea-plant at Tranninh, as M. MIÉVILLE observes (2) belong to two groups of different forms: those of the North Eastern plantations (especially of the Phou-sang plantations) belonging to the group of the 5th Military Post (Laos) and Y-pang (Yunnan) ; and those of the plantations of the South and East, to the group of North Annam and Middle Tonkin.

The result of this investigation is that Tranninh is suitable, from its climate and soil, for tea crops, but that these can only prosper when the conditions for obtaining labour and the transport of goods have improved.

(1) The "Meos" or "Miaos" emigrated from China into Haut-Laos as late as the middle of the XIX century, after the frightful massacres by the Chinese about this time at Kuichou, where the Meos formed the greater part of the population. They are mountaineers living in lofty mountains ; they follow the disastrous "ray" systems (the burning of forest and brush in cultivation). They are good livestock breeders and it is they who grow opium at Tranninh. — (Note from the Correspondence Bureau of Indo-China).

(2) R. MIÉVILLE "Le théier sauvage du Phousang", in the *Bulletin agricole de l'Institut scientifique de Saïgon*, Year II, 1920, summarised in the *Bulletin des Renseignements Agricoles des Plantes*, June 1920, No. 648.

At present this province seems more adapted for such crops as that of the camphor-tree or plants for distilling perfumes, which can be mechanically cultivated and yield products of great value and small volume.

It would be preferable therefore first to consider the formation of tea plantations in other parts of the Annamite chain, also situated at a height of between 1-2000 metres, but nearer the coast, which alone can furnish labour, and having better means of communication with the ports.

While waiting until Tranninh can in its turn become a centre of tea production, the natives might at once be initiated into this cultivation. Attempts had already been made by M. BARTHELEMY, Government Commissioner, and M. MIÉVILLE; but the Laotians allowed the young plants which had been distributed among them to perish. The only way of obtaining results would be to commission the school teachers, in conjunction with their pupils, to establish and cultivate small plantations of about 100 plants. They could also plant some shrubs in the neighbouring villages and superintend their growth.

The younger generation would thus be capable later of furnishing experienced foremen and workmen.

These small plantations would also form a system of experiment grounds which would enable the fertility of the soils to be estimated.

The only species which should be grown is the Phou-sang. This species might be grown not only in Tranninh, but also in the plantations of Annan and Tonkino, where it should replace inferior species.

Unfortunately the Agricultural Station at Tranninh, so far only produces a sufficient quantity of seed to sow barely 3-4 ha. per year. The seed of the best types of tea at this Station should therefore be utilised first, in establishing large seed nurseries. These may become an important source of revenue for the Province. The true future of the tea crop in Tranninh lies probably in this direction, and not in that of tea production. The upkeep and exploitation of a nursery only require a few coolies, and the value of the seed will certainly be higher than that of tea. The proprietors of reproduction nurseries might easily find them profitable, both in Indo-China where the tea industry is developing more and more, and in Ceylon and Java. These two Colonies, not being able themselves to produce the quantities of seed they require, are obliged to import it every year from Assam at a heavy cost and at the risk of introducing the "Blister Blight" disease.

Corr. Indo-China.

591. The Chemical Analysis of Tea with regard to Quality.

DEUSS, Dr. J. J. R. (Chemist, Experiment Station for Tea, Buitenzorg).
L'Agronomie Coloniale, Year II, No. 80, pp. 41-47. Paris, 1924.

The quality of tea is determined by its appearance, the aroma, the infusion resulting from the placing of 3 gm. of tea in 150 cc. of boiling water for five minutes, and the colour of the leaves after infusion.

Chemical analysis has not yet supplied data of value in judging quality. It is importantto know the moisture-content before packing, which should

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not exceed 6 %. The content of caffein, tannin and other substances is of little value in respect to quality, and cannot be used for classification of teas.

Experiments have shown that the caffein-content of fresh tea does not change during manufacture by mechanical methods. Oxidation may reduce the tannin content, or the tannin may become insoluble from too high temperatures during the withering and drying processes. Excessive fermentation reduces tannin-content.

The author gives a summary of the analytical methods followed in his laboratory, and the results obtained from different teas.

Type of Tea	Caffein %
Java teas from different estates	2.7 to 4.4
Japan green teas of different qualities	2.0 » 3.3
China tea (black) from Amoy	2.0
Tai Pin black tea	3.0 » 3.7
Tonkin Green tea, pressed cubes	1.5
Indo-China Flower tea	1.5
Man-Hao tea	3.0
Tonkin tea for export	3.1
Indo-China teas, various	3.2 » 4.1
Formosa-Oolong tea	3.1 » 3.7
Burma tea, buried and prepared by Burmese method	trace
Guatemala tea	3.5

From the data given it is seen that there is no relation between caffein-content and quality of tea, and the same is true of the ash content, which is of use only in investigations respecting adulteration.

A more important factor is the amount of matter soluble in hot water; analysis of different teas gave a maximum of 26 % for Java teas, 22 % for China, 14.7 % for Tonkin tea for export, and only 2.7 % in the case of Flower tea. However, these figures do not indicate quality, which is the case also as regards the tannin content, although the best teas contain a higher percentage of tannin than those of lower quality. It is very important to have fresh tea for determination of tannin content, as in old or mouldy tea much less is found.

No one has attempted to produce better teas by the reduction of the caffein or tannin content.

The author concludes that it is not possible to establish a relation between the percentage of any of the above substances and the quality of tea. As is the case with different vintages of wine, so it is with tea; the good grades are the result of scientific cultivation and manufacture, and the environmental conditions under which they are grown.

W. S. G.

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592. **N cotine and Ash Constituents of the Leaf of Tobacco Plants.**

CUTLER, J. V. (School of Agriculture, Potcheistroom). *The South African Journal of Science*, Vol. XXI, pp. 208-222, tables 6, figs. 3. Cape Town, 1924.

Tobacco leaf from a fertiliser experiment carried out at the Rustenburg Tobacco and Cotton Experiment Station, was examined to ascertain the effect of various fertilisers upon the leaf and the ash; the effect of the fertilisers upon the growth of the plant and the size and grade of leaf was also studied.

Light dressings of lime increased yield per acre, area of leaf and percentage of midrib. Potash alone, gave an increase, but combined with lime grave a decreased yield. Nitrogen produced an increase in total yield, but decreased the percentage of the lighter grades of leaf; midrib was decreased; leaf area was not materially increased. Phosphates gave an increase over all single fertilisers and increased the percentage of midrib, Nitrogen with potash, and nitrogen with phosphate gave increased yields, but at the expense of the lighter grades of leaf. Nitrogen and phosphate increased the percentage of the lighter grades. Complete fertilizer and farm manure gave the maximum return per acre. Nitrogen gave more luxuriant growth with a lowering of quality.

With reference to the ash constituents, the author found that the use of fertilizers had not increased the percentage of mineral constituents, except that potash with lime gave a slight increase.

The ash content of the yellow, red and dark grades of leaf was compared. In the lighter grades there is a slight increase of potash, sulphate and iron, and a corresponding increase of lime and silica. The nicotine content was lowest in yellow leaf and highest in dark red. Application of nitrogen caused a marked increase in nicotine.

Examination of the leaf with various solvents indicates that the nicotine is in combination with the calcium present; where the calcium is in greater quantity the nicotine is not readily soluble in ether, but dissolves more easily in alcohol.

W. S. G.

593. **Essential Oils from Various Parts of the British Empire.**

Bulletin of the Imperial Institute, Vol. XXII, No. 3, pp. 303-333, plates 3. London, 1924.

The article contains an account of the results of examination at the Imperial Institute, London, of essential oils received from various parts of the Empire. In each case are given: a description of the material as received, chemical analysis, characteristics, industrial prospects. The following products yielding essential oils are discussed: Vetiver roots, from the Gold Coast and from the Federated Malay States; Inchi grass (*Cymbopogon coesius*, Stapf) from India; Tsauri grass, (*Cymbopogon giganteum*) from Nigeria; Patchouli oil from Seychelles; Cinnamon oil from Seychelles; Thyme oil from Cyprus; leaves of *Ocimum gratissimum* from South Africa; Huon pine from Tasmania; *Tagetes minuta* oil from South Africa.

W. S. G.

Arboriculture.

594. **Orchard Practices in the Citrus Industry of Southern California.**

VAILE R. S. *University of California, Agricultural Experiment Station Bulletin*, No. 374, pp. 50, tables 27. Berkeley, Cal., 1924.

The purpose of the Bulletin is to show from actual fields records the influence of fertilisation, ploughing, climate, soil, age of trees and costs, on the profitableness of citrus orchards.

The following conclusions are drawn from data collected from about 600 citrus groves, only records being used for analysis that covered a working period of five years.

Citrus groves (in California) produce more fruit per acre near the coast than in the interior, but they do not return higher net profits.

Soils of a medium texture are mainly used, as very sandy soils or clays are less productive.

Citrus trees usually increase in average yield until at least 35 years of age.

Nitrogen and bulky organic manures give the best results. Exclusive applications of nitrogen seem to cause mottling.

Orchards with winter cover-crops gave higher yields than clean-cultivated orchards.

Less irrigation water should be used near the coast than in the interior. W. S. G.

595. **The Banana and its Cultivation.**

Bulletin of the Imperial Institute, Vol. XXII, No. 3, pp. 303-335, plates, 3. London, 1924.

In the article a botanical description of the banana is given, and the plant is then discussed under the following headings: climate and soil, propagation, cultivation, pruning or suckering, harvesting, after-cultivation, packing and transport, diseases, pests, subsidiary products, banana cultivation in various parts of the British Empire.

Two species of banana are grown commercially, a variety of *Musa sapientum*, in Central America and Jamaica, and *M. Cavendishii* or *M. sinensis*, a native of Southern China, a smaller fruit than the former, is largely grown in the Canary Islands.

It is suggested that the West African colonies and other tropical areas, might with advantage cultivate this crop, especially those within a comparatively short distance of the chief European markets.

W. S. G.

596. **Almond Varieties in the United States.**

WOOD, M. N. *United States Department of Agriculture Bulletin No. 1282*, pp. 140, plates 26. Washington, D. C., 1924.

The author gives a description of 151 varieties of almonds grown in the United States, both the more important and those less well known.

A key is supplied to almond varieties, based upon the characteristics of the nut.

The 26 plates are very instructive, and in the index of varieties the reader is enabled to see at a glance the important varieties and those which are not well known or are not grown commercially. W. S. G.

597. **Walnut Culture in California.**

BATCHELOR, L. D. *University of California, Agricultural Experiment Station Bulletin No.* 479, pp. 91, figs. 34, tables 7. Berkeley, 1924.

The Bulletin represents the results of general observations and specific investigations of the author and his associates. The industry is discussed under the following heads: Climatic requirements, soil, water supply, varieties, rootstocks, starting the orchard, culture, diseases and pests, harvesting, curing, packing and cost of production.

The walnut tree bears profitable crops when from 6 to 10 years old, according to variety and environment and the average yield is about 800 lb. per acre; groves which have averaged 1500 lb. for a period of ten years are rare. W. S. G.

Forestry.

598. **Forestry and Agriculture.**

MARSHALL, R. C. (Conservator of Forests, Trinidad and Tobago). *Tropical Agriculture*, Vol. II, No. 4, pp. 70-72. Trinidad, 1925.

Forestry and agriculture are both based on the yield-capacity of the soil; trees are often far less exacting in their soil requirements than are agricultural crops, and can be successfully grown on areas which are quite unsuitable for agriculture.

The indirect utility of forests. The opinion is widely held that forests increase rainfall to a marked extent: EBERMAYER started observations in Bavaria in 1867, but came to the conclusion that in the plains the effect of forests is very small, but increases with elevation. Extensive observations made in Sweden at 400 stations over a period of 15 years showed that land with 56 % under forest certainly did not receive more than 3 % rainfall in excess of land with 17 % under forest. The Government of India has studied the subject and concludes that, if forests influence rainfall at all the effect is insignificant.

Forests, however, have a profound effect on the conservation of water. The trees lessen the force of heavy, tropical rainfall; the surface soil in a forest consists of decaying organic matter capable of absorbing large quantities of water, which is held and eventually passes out as springs which yield a steady supply to streams and rivers. A tropical rainfall on a bare hill-side is not absorbed and causes erosion of the soil and floods in the valleys.

The direct utility of forests. Forests, in addition to timber, produce many important secondary products. In countries where forests have

reached the protection stage, yield tables are available from which the average annual return per acre can be calculated. From the standard formula, under a given set of conditions, the return per acre works out at 18s. and unless this return can be obtained by agriculture it is preferable to grow timber on that area.

Every acre of land round head-waters and along the banks of rivers on which forest cover would protect against erosion and soil wastage, should be forested. All forested lands should be so managed as to yield a maximum of the products most needed by the local communities and industries.

Without agricultural development the present state of civilization cannot be maintained. We had better be without gold than without timber. W. S. G.

599. **Regeneration of Forest Species with the Assistance of "Taungya" in Burma.**

BLANFORD, H. R. (Conservator of Forests, Burma). *Indian Forest Records*, Vol. XI, part 3, pp. 39, plates 10. Calcutta, 1925.

The object of the article is to summarise recent work in forest regeneration with the assistance of the *taungya* method. The word *taungya* is the Burmese name for temporary cultivation on hill land, and is similar to the German system of "Waldfeldbau" or cultivation of forest with crops.

The method may be briefly described as follows: All marketable timber is extracted, after which, in the forests of Burma there remains a bamboo undergrowth and worthless trees, which are felled by the *taungya* cutter and burnt on the land. During the rains rice or other cereals are sown, and the sowing or planting of tree species is carried out at the same time. The tree seedlings are tended by the *taungya* cutter as long as the field crop is on the ground, after which the land is taken over by the Forest Department.

The great advantage of this method of forest regeneration is that it combines the production of a food crop with the forest crop, and so makes possible the establishment of the necessary labour force, often one of the most difficult problems in forest work.

The author outlines a typical case of regeneration on the above system and gives instances where regeneration has been adapted to local customs.

W. S. G.

600. **Reafforestation with Cedar (*Juniperus Procera*) of the Shume Forest Reserve, Tanganyika Territory.**

MABER, E. D. *Quarterly Journal of Forestry*, Vol. XIX, No. 1, pp. [illegible]. London, 1925.

The Shume Cedar Forest is a matured virgin forest situated in the N.W. of the Usambara Mountains at an altitude of 5000 to 7000 feet, and has an extent of about 20,000 acres. There is a stand of 15 to 20 cedar trees per acre, which would yield about 1000 cubic feet of timber.

During the past 3 ½ years the Forest Department has been reafforesting with cedar in the Shume and neighbouring forests. Nurseries have been established ; 2000 seedlings from 1lb. of seed is a good average although more than double that number have been obtained.

Plantations have been made both in open ground, and under shelter wood ; in dry situations the open ground was not successful.

The approximate cost per acre to the end of the second year, of a shelterwood plantation with seedlings planted 4 × 4 feet, is given as £6-8-6. Undergrowth is rapid and five cleanings are necessary in two years in a shelterwood plantation and six or more on an open plantation.

W. S. G.

601. **The Growing of Poles for Electric-Transmission.**

Goudie, H. A. (Conservator of Forests, Rotorva, N. Z.). *New Zealand Journal of Agriculture*, Vol. XXIX, No. 4, pp. 243-253, figs 3. Wellington, 1924.

In writing the article the author had in mind the great development which is taking place in the production and use of electricity, and the very large demand likely to exist in the future for poles for extension of power lines and renewals. It is estimated that for renewals alone, in addition to telegraph and telephone pole requirements, 40 000 poles per annum will be necessary.

The main qualifications required of a pole are strength and durability, hence only poles of the highest quality are employed. For this purpose Australian ironbark poles are used of the following species : Grey or white ironbark (*Eucalyptus paniculata*), broadleaved ironbark (*E. siderophloia*), narrow-leaved ironbark (*E. crebra*), and red ironbark (*E. sideroxylon*). Although the main object of the article is to deal with the growing of trees for pole-production, the author describes species and varieties recommended for farm forestry. Attention is drawn to the advantages of planting the waste places on a farm with trees, which in most cases may just as well be valuable, timber-yielding species, as trees which have a shelter value only.

W. S. G.

602. **Coolibah Timber of Western Australia.**

Bulletin of the Imperial Institute, Vol. XXII, No. 3, pp. 280-284. London, 1924.

The properties of coolibah timber were investigated by the Imperial Institute, London. Coolibah (*Eucalyptus microtheca*, F. v. M.) is found in the drier parts of Australia, except Victoria ; it is estimated that in Western Australia 20,000 tons are available.

The wood is extremely hard, tough and heavy, and has been used for machinery bearings, cog-wheels and tail-shafts bearings. The height of the tree is from 70 to 80 feet, with a diameter of about 4 feet. Average weight per cubic foot, 89.5 lb. ; colour dark brown ; resistance to crushing

and shearing exceptionally high. The wood is very difficult to work and blunts the teeth of power-saws; nails bend and the wood tends to split; good results are obtained by turning. Careful seasoning is essential.

W. S. G.

603. **Balsa Wood from British Honduras.**

Bulletin of the Imperial Institute, Vol. XXIII, No 1, pp. 17-32 London, 1925.

" Balsa " is the local name of a very light wood found in parts of tropical America. The wood is suitable for the manufacture of life-belts, fenders for life-boats, and as a cork substitute for bottle stoppers.

Investigation showed that the weight per cubic foot varied widely according to its distance from the centre of the log. The inner wood weighed about 7.5 lb. per cubic foot, when dry, and the outer wood 21.5 lb per cubic foot. These wide differences in weight may possibly be related to the rapidity of growth of the tree.

The particular variety investigated is known locally as " Polak " (*Ochroma Lagopus*).

W. S. G.

604. **Burma Oak and Chestnut Tans.**

PILGRIM, J. A. (Forest Research Institute, Dehra Dun). *Indian Forest Records*, Vol. X, Part XI, pp. 90, tables IX. Calcutta, 1924.

Part XI of the *Indian Forest Records* forms a report of an investigation from the tannin standpoint of the different parts of various oak and chestnut trees, principally those species growing in the Maymo and Kalaw areas. The oaks of Burma are compared with those of Europe, special reference being made to dyes. The chestnuts of Burma are compared with the Indian *Castanopsis tribuloides*. A list is given of oak and chestnut products which on analysis were not found to be useful.

W. S. G.

LIVE STOCK AND STOCK BREEDING.

General.

605. **Additional Information on the Relations between the Internal Secretary Glands and Immunity.**

MELNIK M. (Pasteur Institute). Contribution à l'étude des relations entre les glands à sécrétion interne et l'immunité. Le corps thyroïde et le Bacille de Shiga. *Comptes rendus des Séances de la Société de Biologie et de ses filiales*, Vol. XCII, No. 7, pp. 474-475. Paris, 1925.

The fundamental principle by which the author has been guided in his investigations is the following: The hormones penetrating by means of the circulation into the organism and bathing all the cells and tissues,

necessarily come into contact, in an infected organism, with the micro-organisms and their secretions ; on the other hand the glands with internal secretion inevitably undergo functional and biochemical modifications under the influence of the microbic activity.

The author has studied the thyroid body in connection with the Shiga Bacillus, which causes dysenteric infection.

He utilised 14 rabbits weighing on an average 2 kg., and of varying age and sex ; 9 of the animals were thyroidectomised and 5 served as checks. 5 days after the operation 2 cc. of a broth culture of the Shiga Bacillus, aged 24 hours, was injected under the skin, both of the animals operated and of the checks.

Of the 9 operated, 4 survived ; of the 5 checks, 4 succumbed after 3 days and 1 after 4 days.

On the second or third day after infection all 14 animals showed clear signs of slight palsy, greatly varying in intensity and duration. The extirpation of the thyroid gland in rabbits therefore seems to favour their resistence to dysenteric infection. P. D.

606. **The Elastic Mucous Tissue of the Cock's Comb and its Reaction on the Sexual Hormone.**

CHAMPY, C. H. and KRITCH, V. Le tissu muco-élastique de la crête du coq, réactif de l'hormone sexuelle. *Comptes rendus des Séances de la Société de Biologie et de ses filiales*, Vol. XCII, No. 9, pp. 683-685. Paris, 1925.

The cock's comb is a complex structure ; it includes a fibrous conjunctive axis, with a little adipose tissue in the middle, the quantity of which varies with the condition of fatness of the bird. This axis contains the large vessels and principal nerves. On either side of it there is a wide strip of special elastic-mucous tissue ; then comes a dense fibrous layer enclosing distended and very close layers, and finally a thick epithelium with a horny layer having numerous cells.

The elastic-mucous tissue is formed of star-shaped cells of which the cytoplasm, full of large cavities, is reduced to a plexus or network. This tissue appears to react against the sexual hormone : indeed, it disappears completely in the castrated bird, whereas the other parts of the comb undergo only slight transformations.

The following are some data on the development of the elastic-mucous tissue : in the embryo there is an epithelial comb under which is a dense mesenchymatous tissue with nothing else of a specific nature except vascular traces. In the young cockerel, up to 70 gms., the comb is of similar structure to that of the capon, without a special tissue. The latter appears in a cockerel of 170 gms., beginning at the base and continuing towards the tip. It is well developed all along the top in a cockerel of 300 gms. and seems from that stage to show a parallel growth with the other parts of the comb.

Castration immediately affects it : after 13 days it undergoes a well defined retrogression, commencing at the tip and continuing in exactly inverse order to its progression in the cockerel.

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In the young hen the tissue is absent until the bird lays; the comb is then similar in structure to that of the capon.

This tissue is not peculiar to the Gallinaceous order and is found in other species, with rather different characters, and in different organs.

The elastic-mucous tissue reacts in connection with the hormone and is a particularly sensitive zone, the sensitiveness of which is only revealed by the action of this hormone itself.

What is altogether characteristic is its equal sensitiveness to the genital glands of either sex. This seems to indicate that in the male the influence of the genital gland is permanent, begins early and continues regularly in spite of the important changes in the genital gland during the period of maturity.

In the female, this tissue only appears at maturity and periodically during the laying periods. P. D.

607. **Vine Shoots as a Cattle Feed.**

GIULIANI R. (R. Istituto superiore agrario in Portici). I sarmenti di vite nell'alimentazione del bestiame. *Rivista di Zootecnia*, Year 1, No 11, pp. 345-3[illegible]. Portici, 1924.

In view of the high prices for fodder and concentrated feeds, the author examines the possibilities of utilising vine shoots as a cattle feed.

According to SPIRA and MENOZZI's analyses, their chemical composition, which varies with the degree of lignification, the species and variety of vine and the nature of the soil, may be estimated as follows:

Chemical Analysis of Vine Shoots.

	Fresch	Dry
	%	%
Water	38.22 %	12.00 %
Nitrogenous substances	2.28	4.40
Crude fat	1.53	1.70
Non-nitrogenous extract	30.73	50.00
Cellulose	24.80	27.00
Mineral substances	5.56	4.10

As regards the digestibility of shoots, the greater or lesser degree of lignification, mode of preparation and distribution must be taken into account; but to form an estimate of their actual nutritive properties, it must be borne in mind that owing to their ligneous nature, a large consumption of energy is required for their mastication and digestion; also they are but little appreciated by livestock, so that in their natural state they hardly constitute a product from which the animals derive much benefit.

Crushing the shoots transforms them into a more appetising product and one which may be added to mixed feeds, increases their digestibility,

and considerably reduces the work of mastication and digestion, i. e. increases their nutritive value.

The most economical types of crushers are those with a high power motor which reduce the shoots to a fibrous mass like hay; other apparatus reduce the shoots into a coarse flour.

The nutritive value of the shoots has been proved by scientific and practical tests.

Prof. TUCCI tested this product on cattle at the Palermo Stock Breeding Institute and came to the conclusion that 150 kg. of shoots replace 100 kg. of hay or 200 kg. of straw; the animals keep in good condition and milk production is not decreased.

Eight kg. of crushed vine shoots, 3 kg. of hay and 3 kg. of oats were substituted for a ration of 9 kg. of straw, 9 kg. of hay and 2 kg. of oats, and this enabled the draught horses given the new feed to keep in good condition.

Prof. VASSILLIÈRE made a test on 10 oxen, 1 cow, 1 mare, 1 ass 1 sheep and 9 ewes. The ration per 100 kg. of live weight was: crushed shoots 17 kg., oat straw 11 kg., decorticated ground-nut cake 2.8 kg., oats 2.250 kg. and salt 0.100 kg. Straw and vine shoots were mixed in bins made of brick and lined with cement, and salt water was poured over the whole; the cake and oats were added to the ration at the time it was fed (thrice daily). An interval of 40 to 48 hours elapsed between the preparation and administration of the mixture, which allowed the temperature to rise to 50-55° C. and thus causing the shoots to become softened.

Good results are obtained by mixing the crushed shoots with molasses in the proportion of 17-18 kg. of molasses per 100 kg. of shoots. The animals freely took the shoots thus treated, and 3.4 kg. per 100 of live weight may be conveniently fed.

The author concludes that vine shoots, properly crushed, may be utilised with advantage for feeding cattle, sheep and pigs.

The shoots should be fed mixed with chopped straw or hay, in the form of a mash with salt water, after the mixture has been allowed to ferment for 48 hours. Concentrated feeds are added at the time of feeding.

The shoots may also be crushed and preserved in silos for subsequent use.

P. D.

Special.

608. **Classification of European Breeds of Cattle.**

MURATTI M. (Ispettore zootecnico della provincia di Udine). La classificazione delle razze bovine. *Rivista di zootecnia*, Year II, No. 2, pp. 1-14, 7 figs. Portici, 1925.

The breeds of cattle are the result of the simultaneous influence of climate, soil and human intervention; climate has a preponderating influence, and, climatic conditions being the same, the differentiation of

breeds is determined by the nature of the soil and agricultural conditions. In addition to natural conditions, the exercise of the functions, methods of reproduction and improvements in cultivation may have a very strong influence on the animals.

Classification should be based on economic qualities and serve as a guide in the application of methods of reproduction.

Certain qualities (utilisation of a certain function) are generally common to all breeds, and a particular charateristic is only met with in exceptional cases.

Climate greatly modifies the organic constitution and characteristics, as well as the nature of the products obtained.

The fact should not be lost sight of that between the factors of agricultural production and breeding production, there exists so close a relation that the value of cattle breeds cannot be properly estimated without a profound and exact knowledge of the agricultural features of the various breeding districts. It is useful to remember the relation existing between the development of characteristics on the one hand, and on the other the physiology of nutrition and the faculty possessed by animals of different breeds to produce, with the same nutritive principles, different products according to their specialisation.

Basing on these principles the author proposes to class the most important European cattle breeds into three large groups:

A) Breeds specially bred for a single characteristic (breeds for one object), e. g., meat production;

B) Breeds raised for two objects (meat and milk or meat and work) these two characteristics being equivalent, or one predominating over the other;

C) Breeds for three objects (milk, meat and work) with the most varied combinations of the three characteristics.

A. — *Single purpose breeds* (*meat production*). These exist only in England: Shorthorn meat producers, Hereford, Devon, Aberdeen-Angus. They are very early maturing, or heavily developed, and have a marked tendancy to fatten. The general appearance of the animals at the first glance reveals their specific characteristic: a compact body, well balanced, wide, supported by short, light limbs. The average weight of the adults is about 900 kg. for bulls and oxen, 600-800 for cows. The yield in butcher's meat varies from 69 to 70 % with 10 to 16 % of fat.

B. — *Dual purpose breeds* (*milk and meat or milk and work*).

(1) *Northern breeds* (*milk and meat*).

(*a*) Breeds in which the milk-producing character is predominant of large size: Frisian, British-Holstein, Dairy-Shorthorn. These breeds have great mammary development; trunk wider at the croup, narrower at the thorax, wedge shaped; exaggeration of the female secondary sexual characters; fairly early maturing, high milk yield and low meat yield.

(*b*) Small breeds in which the milk-producing character is predominant: Ayrshire, Jersey, Guernsey, Kerry, Brittany. The same characteristics as (*a*).

(*c*) Small breeds belonging to high mountain districts, with predominant milk production: Herens, Valdostana. Very hardy.

(*d*) Breeds possessing the two characters (milk and meat) in an equal degree: Normandy, with high meat and milk production, net yield in butcher's meat: 52-56 % for oxen, 45-50 % for cows. Milk yield over 3000 litres with 4-5 % of fat.

All these breeds (B) (1) are of delicate constitution and show slight resistence to climates different from that of their native country, and the stronger their individual qualities, the more marked is this characteristic.

(2) *Central and Southern breeds* (*meat and work*).

(*a*) Breeds with predominant meat production: Charollaise and Limousine: large, long trunk, without bony protuberances, strong bone structure. Live weight of adults: oxen 700-1000 kg., cows 500-800 kg. Net yield of butcher's meat, 50-60 % with 5-10 % of fat.

(*b*) Breeds for draught purposes: Maremmane, Apulian.

(*c*) Breeds for draught purposes and high yield in butcher's meat: Romagnole, Chianina, Marchesan.

The characteristics of the breeds comprises under the headings (B) (2) and (*c*) are: strong skeleton, powerful muscular masses, large deep trunk, firm, well-set joints, large, compact, horny hoofs, high quarters, greater developmnt of the fore quarters than of the hind quarters. These characteristics vary somewhat according to breed, degree of improvement and surrounding conditions. The live weight and net yield likewise vary.

In all the breeds comprised under (B) (2) resistance, strength, hardiness and lack of fineness are in direct proportion with the development of the aptitude for work, and in inverse ratio to that of the aptitude for milk production.

C. — *Breeds for 3 purposes* (*milk, meat and work*).

(1) *Breeds belonging to the Northern slopes of the Alps.*

(*a*) Breeds in which milk production predominates over that of meat: brown Swiss race; dappled Swiss races (Simmenthal, pied-black and pied-red Friburg).

(*b*) Breeds equal in milk and meat production: Moelthal (pied-red of the Austrian Alps).

The average annual yield of cows is about 6-7 times their live weight, according to the degree of improvement (animals weighing 300 kg. giving 1400-2400 l. of milk, those of 500 kg. 2500-4000 l.).

Meat production is in direct proportion to the degree of perfection attained by the different races, being from 45-50 up to 55-60 % of the live weight.

Work production is not high as a rule, the cows being bred for milk production only, and the oxen used for work. The Moelthal race is most suitable for draught purposes.

(2) *Breeds belonging to the South slopes of the Alps and the plain* (*great endurance for draught work*).

(*a*) Preponderating development of the aptitude for work com-

breed with moderate milk production : grey Venetian race. Piedmont plain, Modenese and Reggian, long trunk, greater development of fore quarters than of hind quarters owing to the absence of scientific improvement methods. Moderate earliness in maturing, very large size.

The chief aptitude is for work ; meat production varies according to race and the age, sex and degree of fattening attained by the animals of each breed. Net yield varies from 45-50 to 50-55 and even 55-60 % of the live weight.

The milk depends on the quantity of work required of the animals, feeding and selection. The average live weight of the mountain breeds varies from 300 to 400 kg. and of the plain breeds, cows 400-600 kg. and oxen 500-800 kg.

As regards the breeds comprised under the heading (C), their physical characteristics depend on the one hand on the development of the aptitude for work, and on the other on the development of meat and milk production.

The greater the endurance of the breeds at work, the hardier and coarser are they; the greater their aptitude for milk production, the more delicate do they become.

When the races are properly classified according to the climate and agricultural conditions of the different countries in which they are bred, selection and methods of reproduction may be applied. A more detailed examination of the races of a given country can then be made in order to determine whether, and in what degree, sel ction, crossing or substitution should be applied. P. D.

609. **Feeding Calves on Milk, Supplementary Feeds and Milk Substitutes.**

SCHMID, A. and LANODIS J. (Agronomic Eng. E. T. H.) Die Ernährung der Kälber mit Milch und mit Ergänzungs- und sogenannten Ersatzmitteln. *Separatabdruck aus dem Landwirtschaftlichen Jahrbuch der Schweiz.* 1925. Zentralverwaltung der Schweizerischen Landwirtschaftlichen Versuchs- und Untersuchungsanstalten, Liebefeld-Bern, pp. 62, figs 7. Berne, 1925.

In the 1st part of the *Annuaire agricole de la Suisse*, of 1925, German edition, a work has appeared under this title which is of special interest to Swiss cattle breeders. The authors proposed to ascertain practically the feeding value of the principal feeds used for rearing calves, basing on tests already made. They begin by showing the influence of feeds on calf-rearing in general, statinetg the mhods to be recommended in the rearing of the Simmenthal breed, and the present ideas on the value of supplementary feeds and milk substitutes.

This is followed by a table of the results of the most conclusive experiments hitherto published, the data of which come exclusively from disinterested Experimental Stations (official research establishments especially of Switzerland).

In the third chapter the authors give the results of experiments made at Liebefeld on rearing Simmenthal heifers. Te result of these ex-

periments is that on the whole, calves raised on whole milk, i. e. which have received an abundance of milk (800-1000 litres per head for the rearing period), as is the custom in Switzerland, and a supplementary ration of the usual unmixed feeds and hay, are superior to those reared on milk substitutes. They are superior in actual live weight body development, absolute and relative quantity of nutritive elements consumed and from other points of view also (health, etc.). The advertising in recent years of milk substitutes prepared by industrial processes is in direct contradiction to these practical results, based on figures. This praise is therefore unjustified.

The authors examine the results obtained by the use of milk substitutes, especially in connection with their researches on supplementary feeds. They finally attribute the results obtaind to the fact that most of these substitutes contain nitrogenous matter of low value and mineral salts in ill-balanced proportions, for they contain no vitamines. To these defects, common to all milk substitutes, should be added cost of preparation, which is often wrongly estimated, but which undoubtedly decreases the economic value of these products.

Basing on the results of their experiments, the authors strongly advise Swiss breeders to keep to the whole milk system of rearing, supplemented by unmixed concentrated feeds and hay, and not to be tempted into buying industrial and apparently cheaper milk substitutes. A.

610. **Milk Testing of the Salers Breed.**

GENESTE F. (Directeur des Services agricoles du Cantal). Contrôle laitier de la race Salers. *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. XI, No. 9, pp. 332-336. Paris, 1925.

A milk testing competition has been organised by the " Société d'Encouragement à l'Agriculture du Cantal " ; 10 dairies have been inspected. Every month the Society's inspector paid a surprise visit to each of them. The milk of each cow, at both milkings, was weighed by him and a sample taken ; the sample was sent to the Laboratory of the Agricultural College for analysis. The results were calculated after 300 days' inspection, i. e. a normal period of inspection.

The examination was made on 300 animals and then on 223, one dairy having been attacked by foot and mouth disease.

Of the 223 cows inspected, 14 gave more than 4000 kg. of milk, the maximum being 4775 kg. ; 62 others gave more than 3000 kg. during their period of lactation.

The average annual yield of milk of a Salers cow varied between 3770 and 2194 kg. ; average, 2810 kg.

The fat was estimated by the GERBER method ; the average content varied from 38.8 to 43.4 gm. per litre. The lowest content was observed in the morning's milking, in April and especially in July : 30 gm. of fat per litre.

The annual average richness of the milk from the Salers breed may be estimated at 40-41 gm. per litre

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The average total solids varied: in the morning between 1[illegible]5 and 133.7 gm., in the evening, between 136.6 and 142 gm.; in Autumn the total solids sometimes reached 189 gm. The average annual total solids may be put at 138-139 gm. The figure for solids less fat is very high in the Salers breed, the average varying between 97 and 99.5 gm. The lowest contents 92 and 94 gm., were obtained in April, shortly after calving. P. D.

611. **Pig Breeding in Tunis.**

LÉGER C. (Breeder at St. Germain, Tunis) and TOURNIEROUX J. A. (Inspector of Agriculture at Tunis). L'élevage du porc en Tunisie. *Bulletin de la Direction Générale de l'Agriculture, du Commerce et de la Colonisation*. Year 28, No. 117, pp. 267-311,8 figs. Tunis, 1924 (received in 1925).

From the declarations made by the owners of animals and verified by the Controllers of the Returns, there were, in 1920, 18 699 pigs in Tunisia of which 7 824 were under, and 10 875 over 10 months.

Pig-breeding is carried on in the north and north-east of the Regency, to the north of a line running from Tunis to Kef, and principally in the districts of Tabarka, Tunis, Biserta, Belja and Suk-el-Arba.

The breeds of swine exploited in Tunisia are not native to that Country. They have been imported from Algeria, Italy, Malta and France.

That known as the *Tunisian* variety is the result of a mixture of varieties of the Iberian breed in which the Romagnole reddish-white and Neapolitan black or black-and-white breeds predominate.

The Tunisian variety has horizontal ears pointed forward, an elongated head, tapering snout, short neck and long body and limbs. The skin is sometimes white, sometimes black or black-and-white. The bristles are generally abundant and coarse, especially over the spine and the shoulders of the less improved members are grey, black or reddish-white.

The Tunisian swine are vigorous, hardy, and good walkers and rooters; they thrive well on pasture and forest-land. They are slow in maturing, their form leaves something to be desired, their muscular system is too much developed and they are mostly adapted for meat production.

The Tunisian pig is admittedly defective for sty-rearing owing to its slow development.

The breeders on the outskirts of the town have turned for breeding animals to early maturity breeds: the Craonese, Roma-Craonese cross and Yorkshire.

Crossing the Tunisian with the Craonese gives good results; the pigs are resistant to the Tunis climate and are earlier maturing than the native breed. The pure Tunis breed has to a great extent been replaced by this cross breed, which has proved superior for sty-breeding.

Crossed with the native sows, the Roman-Craonese produce hardy and comparatively early maturing breeds.

The Yorkshire breed crossed with the Roman-Tunis-Craonese increases earliness and yield. At present the Yorkshire-Craonese cross

is pure or mixed with the Tunis, and is often met with as sty-bred on the pig-breeding farms.

The authors next study feeding and deal with the various substances at the disposal of the Tunis breeders, both on the breeding farms and on the market.

The market price of the potato, owing to growth exigencies and the low yield in Tunis, is too high for the potato to be utilised as a pig feed. The mangel, sown in October, December or February according to the district, yields, without irrigation, 25 000 to 50 000 kg. of roots per ha. ready for consumption from June onwards. They keep in the soil until August in the neighbourhood of Tunis and until December or January at Zaghuan, Mateur and Belja.

Fodder carrots succeed well in Tunis ; sown from 1 August up to 15 October and irrigated until the autumn rains, they give a comparatively high yield. The crop is harvested from the end of December until the end of May, i. e. until the beets can be utilised.

The grains employed as pig feeds in Tunis are : maize, barley, broadbeans and sorghum ; the last-named is very suitable for this purpose with the addition of $^{1}/_{8}$ broad-beans or ground-nut cake.

Acorns are used in the north and north-west of the Country. Prickly pears, deprived of their thorns, constitute a feed from August to October which, though not very rich, is useful, and the pigs are very fond of it. For rearing, and especially for fattening, pigs, the authors recommend the cultivation of the melon or pumpkin of the Touraine variety.

The following are also available : unscreened barley and maize flour and wheat offals, small wheat, wheat bran, Rufisc ground-nut cake, coconut cake, maize-gluten, molasses, fig distillery residues, fresh blood and green bone powder. In Tunis, buttermilk and skimmed milk are rare owing to the undeveloped milk industry.

In Tunis there are two methods of production : (1) sty-rearing, and (2) mixed rearing or demi-sty, on the feeds available at the farm, or supplemented by hiring feeding-grounds.

Sty-rearing is only economically possible in the neighbourhood of large towns, where breeders can procure residues from various sources cheaply ; 28 % of the Tunis swine raised on the outskirts of Tunis and Biserta are reared in this way.

For sty-rearing the breeders find it advantageous to construct permanent, simple sties, of which the authors give the plan and details of construction.

In Tunis, swine are slaughtered and sold as fresh meat (1) throughout the year by the pork butchers, who require fat or very fat animals of from 80 to 120 kg. ; (2) from October to April by certain butchers who retail fat, and especially half-fat, pigs of from 70 to 80 kg. The most important exports take place in December-January, and comprise half-fat, fat and very fat animals.

In sty-rearing, the variety which, with the same feed and care, most quickly attains the weight and degree of fattening required by the pork butchers, butchers or exporters, should be exploited.

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The best varieties are the Craonese, Tunis-Craonese cross and Tunis-Yorkshire-Craonese cross. The Tunis variety is admittedly disadvantageous.

The breeding pigs intended for sty-rearing should be selected from among those with the longest and widest bodies possible.

The replacing of breeding-pigs is carried out by two methods: selection, keeping the animals which are most remarkable for shape and earliness, and at the same time, by replacing the boar, avoiding too close consanguinity; or by taking selected breeding-animals from a breeding-farm (annexe of the Colonial School of Agriculture).

The authors then examine the qualities which should be possessed by boars and sows, the production of young pigs, pairing, gestation, parturition, feeding of sows during suckling, weaning of sucking-pigs, castration, feeding, etc.

Owing to the Tunis climate, fattening in the sty should take place from October to May; fattening is begun when the animals reach 55 to 80 kg., i. e. at about the age of 7-14 months, according to the earliness of the variety and the breed.

The authors give advice as to rapid fattening and types of feeding for the first and second fattening periods.

Half-sty-rearing without the hire of feeding grounds. — This is advantageous on many farms in North Tunis owing to their extent and natural resources in feeds utilisable for pigs. In this system the sty is considered as a temporary structure and should be built as economically as possible, at the rate of 1 sq. metre for every 4 breeding pigs and 1 sq. m per 3 ½ head for store pigs.

The Tunis-Craonese cross is the best breed under this system as the Tunis breed is too slow in maturing.

The herd should include a boar, sows of from 1-2 years and pigs for raising of from 4 months to 1 year.

The best times for sending the herd out to pasture on the farm are the spring and beginning of autumn, owing to the abundance of feed at those periods.

After the autumn rains and until May-June, the pigs find plenty of feed. Generally speaking, the period of scarcity is of short duration, the more so that after the harvest the animals can be pastured on the stubble. If the period of scarcity is prolonged, a supplement is given in the evening after the return from pasture.

The best periods for mating are September-October or April-May, so that the young pigs are born in January-February or August-September. Sows which are well cared for give two litters yearly. The boar is separated from the sows during part of the year

During gestation, if pasture is not very rich, 0.500 to 0.800 kg. of bran are added to the feed. The sow, after parturition, goes to pasture in the morning, is brought back at midday to suckle the young pigs, and then returns to pasture until the evening.

During suckling, it is advisable to give the sows a supplement of concentrated feeds: 0.600 to 1.200 of barley mash, dari or bran.

After weaning, the young pigs are sent to pasture when the weath [illegible]
is fine; care must be taken at the period of passing from suckling to pastu-
rage or a stoppage in the growth of the young pigs will be caused; to avoid
this they should, for two months, be given a ration of crushed or soakep
barley mixed with dry grain. This feed, starting at 300 to 400 gms.,
is progressively decreased and ceases at the end of eight weeks.

Castration should be done at the age of 3 or 4 months.

In times of scarcity the animals are given additional food: from 2 to 5 kg. of boiled beets and 0.5 to 1 kg. of dari, barley bran or maize per head per day according to age and the quality of pasture.

The pasture lasts from 4-6 years, and the less rich the soil and the greater the number of head put out to pasture, the sooner it becomes exhausted.

When the pasture and stubble suffice for feeding the pigs, rearing without the hire of feeding-grounds is very lucrative, requires no great outlay for buildings and does not interfere with the raising of cattle or sheep. The difficulty in this case is that of tending.

The hiring of feeding-grounds in connection with rearing. — This system is followed by certain farmers from the end of October, when their own pasture becomes exhausted, until the middle of June, when harvest begins and the stubbles become available.

The forest feeding grounds advantageous for swine-rearing are formed of the oak plantations in the districts of Tabarka, Sus-el-Arba and Bizerta. The cork-oak is the predominant species; it fruits annually and the swineprefer the acorns of this species, which fall from the end of November until the end of February.

The zeen-oak grows in the cool soil of the valleys, fruits twice a year, and the acorns fall from the end of October until the end of December. To render them fit for consumption by the pigs, germination should have commenced, thus decreasing their astringency.

The evergreen-oak grows in varying quantities with the cork-oak
and its acorns fall from the end of January until the beginning of May;
they are the least sought after by the pigs.

Dense and vigorous plantations of these three species of oaks pro-
vide a good feeding ground; the fall of acorns lasts from November to
May. The underwood however should not be impenetrable, nor should
the ground be too high or exposed to the north, also there should be
springs or water courses which do not dry up before the middle of June.

The feeding grounds are preferably leased to those dwelling along
the forest border. Good feeding grounds are seldom available; where
obtained, the hirer must come to terms with the previous tenant as re-
gards indemnity for the buildings which the latter has erectd.

The authors give in detail the regulations for swine forest feeding
grounds and a list of the charges incurred by leaseholders. Before sending
herd to the feeding ground, the breeder should by a careful inspection
of the area ascertain the number of pigs it can support, basing on the
supply of acorns. The advice of the district forest keeper and of [illegible]
experienced breeder should be taken. The forest shelters or huts [illegible]

constructed very roughly, near a spring or water-course, on soil which is not clay, sloping, and preferably in a clearing ; 3 to 3 ½ pigs are reckoned per sq. metre.

The recruiting of swine herds is fairly easy among the native tribes of the forest zone, but difficult from among the other tribes. Two swine herds are required per herd of 80-120 pigs. The wages are at present from 75 to 100 francs per swine herd for the 7-8 months of feeding.

For the production of young pigs, the same variety of animals are used as in raising without the hire of feeding grounds : the births should take place in January-February or in July-August. A supplementary ration of acorns or barley is given to the sows in pig ; likewise during suckling they receive in winter 1 ½-2 litres of barley in the evening, and in summer, morning and evening, a ration of boiled beets and barley, the quantity increasing progressively from 1 litre to 3 litres.

The young pigs should not be sent to the feeding ground before the age of 4-5 months for fear of the jackals ; nor should they be sent there during rain, snow or hail, otherwise mortality is high.

The herds on the feeding grounds should be carefully watched, for, if left to themselves, the native swine herds are very careless ; the owner should make frequent visits to the ground, count the animals, superintend the distribution of the supplementary ration, indicate the part of the ground where the herd should be led, etc.

Stubble follows acorns. The breeder often makes arrangements with a large cereal proprietor for pasturing on the stubble from the middle of June until 15 October. The proprietor takes over the herd after it has been weighed, and undertakes tending at his own cost. When the breeder takes back the herd, it is again weighed and the proprietor is paid half the value of the increase at a rate agreed on beforehand. Sometimes the stubble is simply hired and tending is at the expense of the breeder. As far as possible stubble should be chosen where the animals find water for bathing during the heat of the day. The value of a stubble-feed depends on the quantity of feed-plants grown by the soil in addition to the ears of cereals and the texture of the soil.

Between the fall of acorns and harvest there is a longer or shorter transition period according to the abundance of acorns and the spring rains. When the acorns are exhausted, rootable pasture should be procured for the pigs or they should be given an additional feed of 300-500 gms. of barley or bran.

At weaning (2 ½ months) the young pigs weigh 12 to 16 kg., at 6 months, 20-30 kg., and at 1 year 55-60 kg., if they have been reared well on the half-sty system. The swine sent to pasture at the age of 13-15 months weigh 50-60 kg. ; if acorns are abundant, they reach 70-80 kg. at about 18 months. They are then half-fat, and are sold either to the butchers or to the fatteners, who keep them 30-45 days in the sty and then sell them fat or very fat ; sometimes the breeder carries out this latter operation himself. It is generally advantageous to deliver fat or very fat pigs, for the sale-price per kg. is higher than for half-fat animals.

The active supervision necessary in half-sty rearing with hiring of feeding ground has led breeders to hire out the animals on the following conditions:

The breeder supplies the herd, shelters, and stubble, and pays the hire of feeding ground. The landlord undertakes the rearing and superintending, and receives half the profit realised on the herd.

The financial results of half-sty rearing with hire of feeding ground are irregular. Generally speaking, for 100 swine reared and sold fat or very fat, the sale price of 75 covers expenses and that of the remaining 25 represents net profit.

The authors then deal with the chief diseases of swine, and which breeders should know how to recognize and treat, as the breeding farms are often far from districts where there is a veterinary surgeon. The following are discussed: scab, lice, diarrhoea, angina, heat-stroke, foot and-mouth disease, the symptoms of each disease being given and the remedies to be applied.

P. D.

Poultry.

12. The Evolution of Potentialities in Chickens.

PEZARD, SAND and CARIDROIT. L'évolution des potertialités chez la poulotte. *Comptes rendus des Séances de la Société de Biologie et de ses filiales*. Vol. XCII, No. 7, pp. 495-496. Paris, 1925.

Ovariectomy causes the appearance of the cock's plumage in the hen. It has been concluded therefrom that the male plumage exists in a potential state in the adult hen and that it is blocked by an ovary secretion.

Certain breeds of poultry show precocious sexual dimorphism, differing from the definite dimorphism. The authors have examined generation G birds of the Silver Dorking × Golden Leghorn cross to find out whether the hen shows a synchronic male potential evolution, i. e. whether precocious ovariectomy is followed by the appearance of the adult male plumage or by that of the young male.

The plumage evolution normally presents 3 successive aspects:

(1) *Chick down:* lasting from 15-20 days; aspect and colouring similar in both sexes.

(2) *Early plumage:* in the young female bird this plumage at first has the form and pigmentation of the adult.

(3) *Adult plumage:* the metamorphosis only takes place in the cock; the final plumage becomes established towards the age of 3 months, the transformation requiring about 1 month, during which there is juxtaposition of early and adult plumage.

If ovariectomy be performed on a young pullet, she is observed to acquire the plumage of the young cockerel which serves as a check, and not that of the adult cock. At a certain moment, the ovariectomised pullet presents a remarkable case of mottling, for he shows three different plumages: (*a*) young pullet's, (*b*) cockerel's, (*c*) cock's.

There is juxtaposition of an abnormal gynandromorphism (young pullet plus cockerel) and of a pseudo gynandromorphism (cockerel plus cock).

Ovariectomy shows that the potentialities of the hen's plumage also apply to the precocious characters.

The immature ovary exercises an endocrinian influence over the plumage, and consequently the hormonic action of the ovary must be considered as very precocious. P. D.

813 **Growth of Single Comb White Leghorn Chickens.**

LATIMER, H. B. (Department of Zoology and Anatomy, University of Nebraska). Postnatal growth of the body, systems and organs of the single comb White Leghorn Chicken. *Journal of Agricultural Research*, Vol. XXIX, No. 8, pp. 363-397, 21 figs., bibliography. Washington, D. C., 1925.

In his experiments the author used single comb White Leghorn chickens, supplied by the Division of Poultry Husbandry, and divided into 4 groups. From the beginning of the test the chickens received a mixture of maize and a paste, both purchased on the market. Afterwards the feed was placed in hoppers containing equal quantities by weight of the following: bran, bran plus maize gluten (hominy), wheat offals, ground oats and meat meal.

As soon as the chickens were large enough, they were given a mixture of crushed grain: maize, oats, etc., and then, whole grain. They also had milk at their disposal. Later they were given, in addition to the usual ration of grain, a paste composed as follows: maize flour 6 kgs., ground oats 6 kgs., wheat offals 4 kgs., bran 2 kgs., lucerne meal 2 kgs., meat offal 7 kgs., 1/4 kg. of charcoal, 1 % of common salt and 3 % of bone meal.

A complete autopsy was made on 100 normal chickens: 50 from group 1, 15 from each of the groups 2 and 3, 14 from group 4, and 6 older chickens as checks.

The chickens in group 1 were weighed once a week; those in the other groups every day at first, then 3 times a week. The weighings took place in the morning, before the chickens received their feed and were set at liberty. Those of the same group were weighed at the same time in order to determine as nearly as possible the average weight per chicken.

In the choice of those selected for the autopsy, chickens of different ages were taken, the weight of which was as near as possible that indicated by KIRKPATRICK as the normal weight of the chicken at the age in question.

The author then describes in detail the process followed for determining the weight of the different organs and the lineal measurements.

The data collected on the special cards for each of the birds subjected to autopsy then served for calculating and constructing the different curves and graphs contained in the publication. The author gives detailed information of the method adopted and the empiric formulae utilised in calculating the curves.

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The principal conclusions arrived at through this investigation are as follows:

(1) The curve of postnatal growth and of the whole body of the chicken shows 3 chief phases: first a period of slight growth, including a decrease in weight of short duration; a second period of rapid growth, during which a difference in body weight according to sex begins to show itself; finally a third period of slow increase in weight.

(2) There is a great difference in the weight of the head as between the sexes, probably due to the greater development of the crest and wattles in the male.

(3) The increased weight of the skin (not including the feathers) is in direct proportion to that of the entire body: the skin forms about 9 % of the net weight of the body.

The plumage increases in actual and relative weight until sexual maturity; then there is a decrease in net and relative weight and the growth curve of the plumage afterwards rather resembles that of the thymus.

(4) The muscular system increases from 21.22 % of the weight of the body, up to 50 % in the case of in adults.

(5) At the beginning, the skeleton increase in weight a little less quickly than the entire body; it is 11 % of the weight of the body in the male adult and 8 % in the female. The weights and lineal measurements show that the skeleton of the female develops more quickly than that of the male.

(6) The digestive tract and its dependencies (proventricle, gizzard and intestines, pancreas) show an initial increase in relative weight of short duration, followed by a slight decrease of this weight up to maturity.

The empty digestive tract reaches a maximum of 18.5 % of the body weight at the age of 6 days, decreasing to about 5 % of the body weight in adults.

The weight of the contents of the digestive tract is extremely variable. The vitelline sac was found in all the dissected chickens up to the 38th day inclusive; with one exception, it was afterwards found in chickens until the 237th day.

MECKEL's diverticulum is always present.

(7) The liver decreases in weight from a maximum of 6.2 % of the body weight in all the young birds to about 2.5 % of this weight in adults. Its weight increases considerably in the older birds, and especially in fat hens.

(8) The weight of the trachea and lungs varies, and shows a decided difference according to sex, being higher in the adult male chickens.

(9) The heart shows a considerable increase, both in actual and percentage weight, this increase taking place at the end of the growth period, commencing when the gross weight of the body reaches 1400 gms.

(10) The upper portion of the curve representing the actual weight of the thyroid gland is entirely concave. The % values vary from the moment the gross weight of the body reaches a minimum of 200 gms until it reaches a maximum of 400 gms.

(11) Both the relative and absolute weight of the thymus increases until maturity, then shows a retrograde movement, decreasing in relative and absolute weight. These modifications are more closely connected with age than body weight.

(12) The suprarenal glands and the pituitary gland vary somewhat in weight, but do not show ay difference as between the sexes.

(13) The kidneys show a decided initial increase from 0.6 % on the day of hatching to 5 % of the body weight at the age of 5 days ; this initial increase is followed by a slow decrease to about 0.6 % of the body weight in adult birds.

(14) The ovary, oviduct, testicles, comb and wattles vary greatly in weight. These organs have a tendancy to form a growth curve of 4 phases, with a notable acceleration of increase at the age of puberty.

(15) The brain, backbone and pupils of the eyes quickly increase in weight at the start, and afterwards more slowly. The relative weight (%) of these organs does not show an initial increase, but gradually decreases from the time of hatching.

P. D.

FARM ENGINEERING.

Irrigation.

614. The Relation between Water Supply and Plant Growth on Irrigated Land.

SUTTON W. C. *South African Irrigation Magazine*, Vol. III, No. 4, pp. 275-280. Pretoria, 1924.

The irrigation farmer is faced with the problem of how the crop will respond to the application of water, and how rapidly it will consume the water stored in the soil. The author's investigations were carried out to determine the relation between crop yield and the amount of water used by the plant in growing to maturity.

Various areas were reserved for the experiment : in one the soil was uniformly fertile, another was of average fertility and a third was uniformly poor land. A very large number of plots were employed, to which were given different quantities of water. The results were plotted out in graphs, as shown on page 912, from which it is seen that in the case of wheat, on fertile land the maximum yields was obtained with about 21 in. of water, for average soil 22 in., and for poor land about 26 in.

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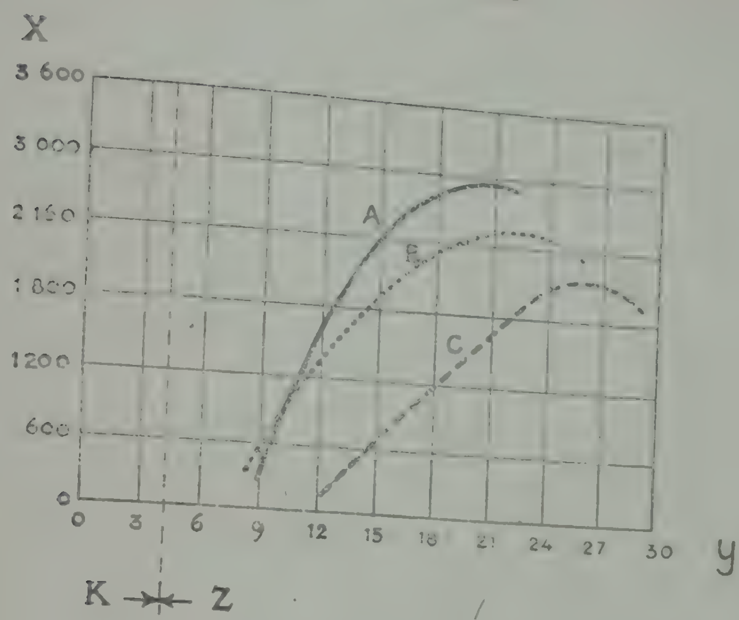

FIG. 131. — Relation between quantity of water used and yield of wheat.

X = Yield in pounds per acre.
Y = Total quantity of water absorbed in inches (sum of soil water and irrigation water absorbed by plant — rainfall 4 ¼ inches).
A = Fertile soil : B = average soil : C = poor soil.

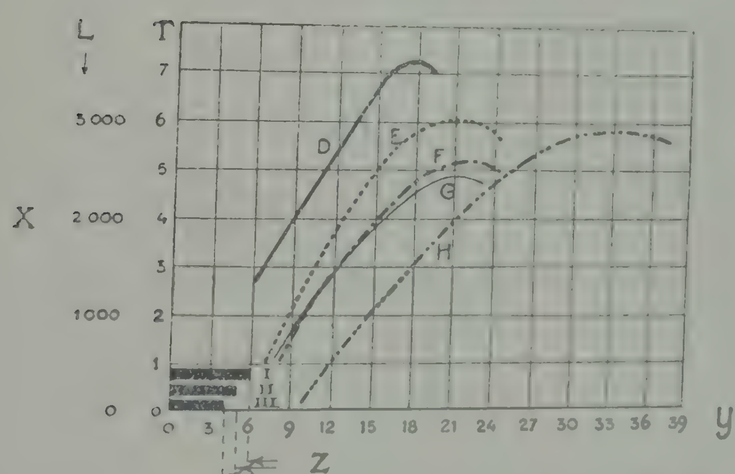

FIG. 132. — Quantity of water used and yield of crops on average soil.

X = Yield per acre.
Y = Total quantity of water absorbed in inches (irrigation and soil waters).
Rainfall : potatoes 6 ins., lucerne 5 ins., cereals 4 ¼ ins
D = potatoes (tons) ; E = oats ; F = wheat ; G = barley;
H = lucerne (tons(, L = pounds : T tons.
I = Potatoes ; II = lucerne ; III = cereals.

From the curves it is seen that the yield increases with the increase of water, up to a certain point, after which further application of water causes a reduction in yield. It is generally sound policy to apply less water than the amount necessary to produce maximum yield per unit area. The irrigator should try to stimulate the yield of that part of the crop which is of greatest value, as this can be controlled to a considerable extent by the time of application of water; *e.g.*, irrigation at the wrong time will stimulate the growth of the straw of wheat, rather that the grain.

The collection of data and preparation of charts will indicate the total amount of water that a farmer can economically use under an efficient scheme of irrigation. The value of such figures is of the utmost importance in controlling sound economic proportioning in the design of an irrigation scheme. W. S. G.

615. **A Short History of Irrigation in South Africa.**

LINSCOTT, C. O. *South African Irrigation Department Magazine*, Vol. III, No. 2, pp. 50-58. Pretoria, 1924.

The author gives a brief outline of the first settlement at the Cape in 1652, and passes on to the year 1820 when 4000 farms were allotted to British settlers, about which time irrigation spread rapidly. In 1900 Sir William Willcocks was sent out by the Government to examine the irrigation possibilities of Cape Colony, Orange River Colony and the Transvaal, and in 1923 the Irrigation Department was formed.

The potential irrigable area in the Union of South Africa is given as 3 000 000 acres, of which area a little over 25 % is now under irrigation. The present total storage capacity is 25,220,000,000 cubic feet. In many districts new constructions and extensions of present irrigation works are taking place. W. S. G.

Methods of Cultivation.

616. **Cultivation of Wheat in Austria by the Spaced-Row and Hoeing System.**

I. — PRIMITZ (Oekonomieverwalter). Die Getreidehackkultur, figs. 12, pp. 24, Verlag Gerold, Vienna, 1924.

II. — GROYSBECK (Gutsbesitzer). Die Hackkultur des Getreides mit Ackerbeetkultur, pp. 27. Vienna, 1924.

III. — PRIMITZ (Oekonomierat). Hackkultur *Die Agrarische Woche der Landes-Landwirtschaftskammer* 19 bis 23 Mai, 1924, pp. 5. Vienna, 1924.

IV. — ALBRECHT (Konsulent für Pflanzenbau). Die Hackkultur beim Getreidebau. *Mitteilungen der Niederösterreichischen Landes-Landwirtschaftskammer*, No. 9, p. 2. Vienna, 1923.

V. — SCHIESSTL. Reform-Getreidebau, published by the Author at Klein-Soell, Post Kundl, Tyrol.

VI. — Schriften des Vereins zur Förderung der Ackerbeetkultur in Linz

VII. — Merkblätter der Beratungsstelle für Ackerbeetkultur in Wien, III, Diestlergasse 10.

VIII. — Merkblatt des Bundesministeriums für Heereswesen für die chinesische Ackerbeetkultur, z. 1260 der Abt. VII, 1922.

IX. — PAWLIK (Gutsdirektor). Erfahrungen mit der Hackkultur. *Wiener landwirtschaftliche Zeitung*, No. 81, p 1, 3rd October, 1924. Vienna.

X. — MITTERHAVSER (Direktor der landwirtschaflichen Schule in Wiegelsdorf. Ergebnisse der Getreidehackkultur an der landwirtschaflichen Landeslehranstalt in Wiegelsdorf. *Weiner landwirtschaftliche Zeitung*, No. 81, p. 1. Vienna, 1925.

Encouraged by the results which had been obtained in Germany bgyrowing wheat in rows with wide spaces between, and also by the teaching of DEMSCHINSKY, many farmers in Austria have been engaged for years with the question of the introduction of the hoeing system into the latter Country. The effort to increase field production and thereby improve the food supply has also helped in this direction.

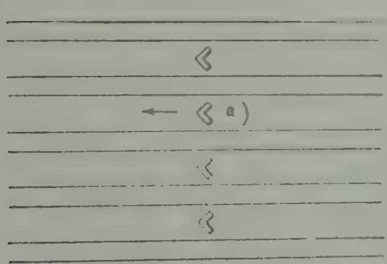

FIG. 133. — Method of hoeing *a* direction of furrow.

The method may be carried out in three ways: the first is to try the old method followed in China of frequent transplanting, and repeated earthing up of each separate plant, and to bring this method into general use. The tests however have shown that this practice may be followed in gardens, but that the greater expenditure for labour is out of proportion to the increase in yield. Small field tests have shown that this process after a long trial has not been attended with the desired results under the more unfavourable soil conditions found in the dry Austrian climate.

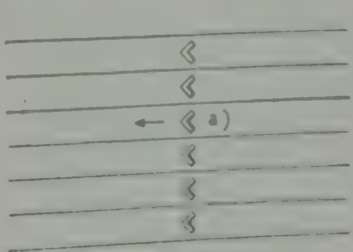

FIG. 134. — *a* = direction of furrow.

The second tendency is towards the single grain sowing by specially constructed seed drills. The field must be cultivated and the wheat earthed up. This method also failed to give the desired results. The sparsely sown grain was to a large extent exposed to the attack of animal pests, and as gaps could not be avoided, either through the machine not working in places tr through the low germination of the grain sown, many places in ohe field remained vacant. Hence yields fell and weeds flourished. The slight rainfall, averaging 500 mm. yearly in the principal corn-growing districts of Austria, hindered tillering, and the development of ears and grains which had formed, hence yields were seldom large and often poor in quality.

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In the third method followed, the usual push-wheel drill was used. As a variation from the ordinary sowing, however, some of the seed-drill shares were removed. For sowing in rows whit spaces between every third share was taken off and only two left to work (a), so that a series of rows are formed with spaces between, and thus cultivation can be properly done.

For sowing in widely-spaced rows, every second share is taken off, so that only the alternate drills (a) function. Thereby regular, wide spaces are left between the rows of wheat which are hoed.

In ordinary sowing, the soil always remains untilled between each double, dense row. Here there is no aeration, earthing-up or weeding; hence yields are much smaller than when sowing is done in widely-spaced rows, and most farmers have abandoned the former method. Only farmers who are anxious not to lose a row of germinating corn, to compensate for any loss which may arise, as for instance through wintering and frost, still keep to it, for in this case they still have the corn of the second row, which is not the case when similar losses accour in spaced-row sowing. But these considerations are of no practical importance.

Spaced-row sowing has mostly come into favour. It can of course only be done where the soil is well tilled and not over-run with weeds, where good seed is used and careful cultivation of the wheat is possible.

Basing on experience gained up to the present, about the following quantity of seed is grown per ha:

	kg.
winter wheat	100
" barley	90
" rye	100
summer wheat	90
" barley	90
" oats	80

These quantities are 40 - 60 % less than those used in ordinary machine-drill sowing.

Field crops sown in autumn are cultivated in the autumn and spring. Winter wheat, which responds especially well to hoeing, is, where possible, again hoed in spring after about 70 kg. of nitrate of soda per ha. have been applied to the soil shortly before.

For spring crops it has been found necessary to sow very early, so that hoeing may follow at a time when the winter moisture is still remains in the upper soil layers at the disposal of the young plants, as they need this for a strong stem growth.

Oats respond to row-sowing better than barley or summer wheat, because they have a stronger stem growth. Winter crops are always better than those sown in spring.

[616]

After several field tests, carried out on a large scale at Immendorf, the tillering of winter wheat, after spaced-row and ordinary machine-sowing, was on an average as follows:

spaced rows

27	plants with	1	stem	=	27	stems
25	" "	2	stems	=	50	"
19	" "	3	"	=	57	"
8	" "	4	"	=	32	"
1	" "	5	"	=	5	"
3	" "	6	"	=	18	"
2	" "	7	"	=	14	"
2	" "	9	"	=	18	"
1	" "	10	"	=	10	"
1	" "	11	"	=	11	"
1	" "	19	"	=	19	"
90	plants with a total of				261	stems

ordinary machine-sown

142	plants with	1	stem	=	142	stems
15	" "	2	stems	=	30	"
3	" "	3	"	=	9	"
5	" "	4	"	=	20	"
2	" "	5	"	=	10	"
167	plants with a total of				211	stems

The average stem growth with spaced rows was therefore 2.9, with ordinary sowing, 1.2 stems.

On the Immendorf estate, the winter wheat yields in 1922 were *eleven times* the quantity of seed sown by the *ordinary method*, and 24 times that shown in *spaced rows*.

In 1923 ordinary sowing gave a 14-fold increase, and spaced rows a 26-fold increase.

In 1924 the proportions were: 11 times by the ordinary, as against 19 times by the spaced row method.

Even in this comparatively infavourable year the yields per joch (1 joch = 0.5754 ha.) were:

980 kg of grain from 86 kg, ordinary sowing, and 1112 kg from 56 kg spaced row sowing.

Summer barley 1922:

Ordinary sowing	88 kg. seed, 1300 kg. yield
Spaced row "	60 " " 1400 " "
Winter rye 1924:	
Ordinary sowing	104 kg. seed, 1050 kg. yield
Summer barley 1924:	
Ordinary sowing	84 kg. seed, 1090 kg. yield
Spaced row "	48 " " 1224 " "
Oats 1924:	
Ordinary sowing	65 kg. seed, [illegible] kg. yield
Spaced row "	40 " " [illegible]

In most cases the cost of hoeing was covered by the value of the seed saved in sowing, so that the increased yields of grain and straw represent a net profit.

[616]

The following results obtained in practice are also worthy of attention: wheat grown in spaced rows has a stronger stem and does not lodge so easily as the other.

PAWLIK reports the following test and its results:

On a field in which mangolds had been grown and fertilised with stable manure and potash the previous year, oats were grown, in lots I and II in rows with a distance of 10 cm. between and in lot III, with a distance of 20 cm. between the rows. No preliminary treatment was applied to lot I. Lot II, after the germination of the oats, was harrowed with a heavy iron harrow, and lot III was hoed once.

The yields per ha were as follows:

	Grain — kg.	Straw — kg.
Lot I (untilled)	14.8	25.3
" II (harrowed)	15.2	29.2
" III (hoed)	18.2	43.9

In contrast to these favourable results, other less satisfactory ones were occasionally obtained. But the latter was mostly the case only when the field was heavily overgrown with weeds, which, in the wide spaces between the wheat obtained more light and grew better. An excessive growth of weeds, therefore, to the detriment of the wheat was observed especially where hoeing was not done at the right time. A high earthing up of the wheat when in dry surroundings and with a light soil, also proved to be a mistake. Through earthing-up, tillers of the young plant were covered, and root-laterals and new tillers developed. But as there was not sufficient moisture in the soil to furnish a proper supply of water to these shoots, they could not develop, or only at the expense of the other stems. Scarcely so much straw therefore was obtained, and less and, especially, lighter grain, than by the ordinary method. Where the soil was hoed but not ridged, these unfavourable results did not occur where a good quality of soil rendered possible vigorous stem-growth. On quite poor soils, as for instance the grounds of the Agricultural Station at Weigelsdorf, a vigorous stem growth is not usual. There the yields from a thin sowing are much below those obtained from the customary thick sowing.

The yields obtained per ha. were:

	Rye — kg.	Straw — kg.
ordinary sowing.	19.60	56.20
sowing in rows (every 3rd share taken off).	14.34 (hoed twice)	51.00
spaced rows (alternate shares taken off)	13.40 (" ")	43.60

Fig. 136 (Plate LX) shows a simple, light hoe, which can be so turned by the driver as to avoid damaging the rows. The hoeing part is fastened

by a bolt to the fore-carriage. To ensure easy running of the gear, left and right of this bolt is a smooth iron bar (S), on which the gear slides backwards and forwards.

The method of working is shown in fig. 135. and Fig. 137 (Plate LX) shows how the machiue works. It is built according to the plans of PRIMITZ, Immendorf (Lower Austria) by the "Ora", Babenbergerstrasse 5, Vienna I.

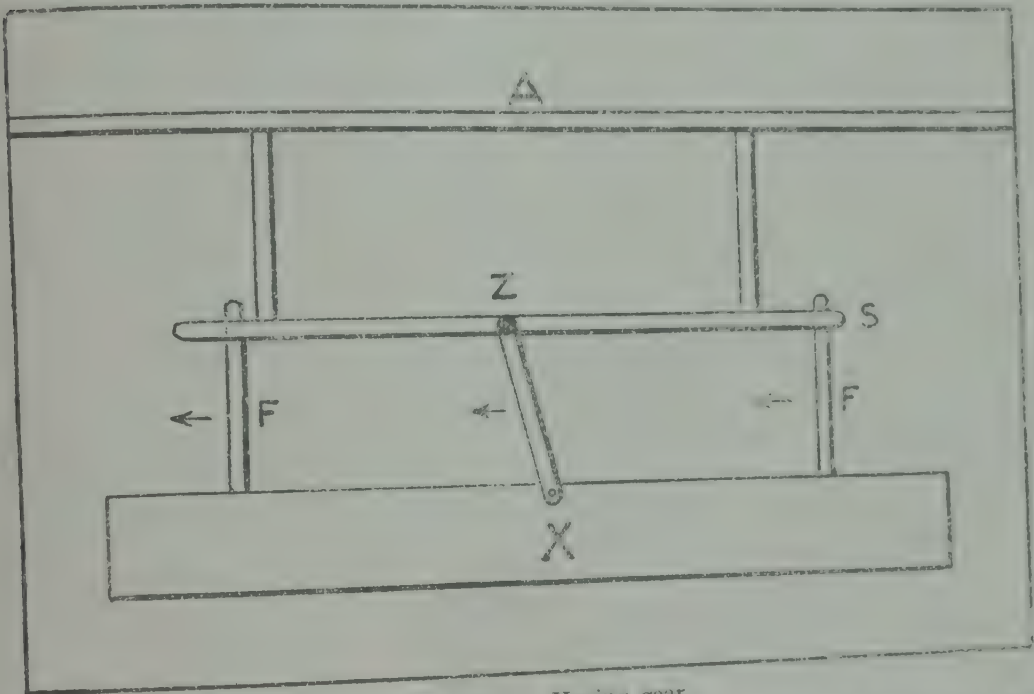

FIG. 135. — Hoeing gear.

Detailed plan of hoeing gear, which is pivoted by the bolt Z to the forecarriage. The
position of the gear is set over to the right. The arrows show how the gear can be brought
over to the left. In order to lighten the weight on the steering-gear, 2 guiding rods (F) are
fastened to the apparatus, which move backwards and forwards on bar (S) which is connect-
ed strongly with the fore-carriage.

Besides this apparatus, there are many other types in use, e. g. small
2-wheel machines (Plate LXI, fig. 138). Plate LXII. Fig. 139, shows
cultivation with an ordinary seed drill, from which every second drill has
been taken off; Fig. 140, the condition of the wheat after hoeing. Figs. 141
and 142 (Plate LXIII). the same after the formation of the ears. These
figures show the excellent growth and vigorous development of all parts,
in fields under the hoeing system.

Field with few weeds can be hoed with machines. Those overgrown
wiith weeds must be hoed by hand.

Soils poor in nutrient matter and water cannot produce vigorous
tillering of wheat grown thickly in rows. On such the advantage of hoeing,
especially that in which earthing up promotes stem growth, was not realised.

The hoeing method is being more and more adopted in Austria, but
tests and investigations to an increasing extent are still being made in
order to find out the most favourable climatic conditions of the hoeing
system.

H. K.

6.0-621

617. **Mechanical Tillage on Sugar Plantations.**

DASH, Prof. J. S. (Imperial College of Tropical Agriculture, Trinidad). *Tropical Agriculture*, Vol. 1, No. 7, pp. 108-110. Trinidad, 1924.

The main purpose of this article is to draw the attention of planters to recent developments in the use of machinery, especially with respect to tillage and cultivation on sugar plantations and in connection with other tropical crops.

The most important object of tillage is modification of soil structure, which affects retention of moisture, aeration, heat absorption, etc., and through these the biological and chemical processes of the soil.

By the adoption of machinery the tillage of cane land can take place during the drier months, instead of partly during the rainy season, thus lessening the risk of damage to clay soils. Larger areas can be worked in a given time and increased crop yields can be obtained.

Labour conditions, even in the tropics, are becoming worse, and the introduction of machinery increases the output per man.

In Hawaii 90 % of the ploughing is done by steam ploughs; a recent introduction is a tractor-drawn planting machine which can plant six acres of cane per day. Another new implement is the « Killefer » subsoiler, of which there are now about fifty in Hawaii; this is a heavy-draught plough requiring a 60 HP.-tractor to break up a hard pan at a depth of 22 inches. This implement has been successfully used in British Guiana where is has been hauled by a cable.

In Porto Rico the Storey plough is employed, a new implement which, instead of share and mouldboard is equipped with revolving knives attached to rotary drums; these knives stir and pulverise the soil to a depth of 8 to 24 inches and leave a fine mulch on the surface. From 5 to 10 acres per day can be worked.

The Howard sugar cane trash cutter and plough has a combination of knives and revolving cutters, which cut cane trash into short lengths, and the trash is then buried by a set of ploughs attached to the rear of the machine.

In Trinidad a heavy disc harrow has recently been employed, fitted with 30 inch discs. This has been found to be more efficient than the drag type with spikes, and cuts up the trash into short pieces which can then be covered by ploughs. On one estate, with two sets of ploughs and one set of harrows, drawn by a Fowler engine, 700-800 acres can be worked in four months, at an approximate cost of £ 3 per acre for ploughing and harrowing inclusive of labour, fuel, repairs, etc.

The author alludes to the loss of time caused by breakdowns, delays in starting, etc., which may amount to as much as 20 % of total working time. By instituting a daily report system to check the work of each driver, better supervision of the machines has resulted and much time has been saved.

W. S. G.

FIG. 136. — "Immendorf" hoe.

FIG. [illegible] — Machine ready for hoeing.

FIG. 138. — Hoeing a wheat-field with the single-wheel hoe.

PLATE LXII.

FIG. 139. — Seed-drill for spaced-row sowing and field ready for sowing.

FIG. 140. — Wheat-field after hoeing the previous year

FIG. 141. — Rye field during heading.

FIG. 142. — Rye field 14 days after heading.

618. Trials of Sub-Soiling 1924.

Journal of the Ministry of Agriculture, Vol. XXXI, No. 10, pp. 925-930, tables 6. London, 1925.

The Ministry of Agriculture (London) in cooperation with the East Anglian Institute of Agriculture, in 1923 laid down a series of sub-soiling trials in Essex and further plots were subsoiled in Oxfordshire in 1924.

On a sand and gravel field subsoiled to a depth of 5 in. an increased yield per acre was given of potatoes, worth from £15-£20, and a barley crop following the potatoes was valued at £6 17s 11d per acre more than the crop on plots only ploughed. Where the subsoiling was deeper (7 in. to 9 in.) the increase was less.

In the case of heavy land, with oats grown on plots subsoiled to a depth of 5 in., 7 in. and 9 in., the weights of grain were respectively, 23.4 %, 31.9 % and 25.9 % more than those of the control plot. The weights of straw were 26.8 %, 36.9 %, and 38.7 % more than those of the land not subsoiled.

W. S. G.

619. Experiments with Fallow in North-Central Montana.

MORGAN, G. W. *United States Department of Agriculture Bulletin* No. 1310 pp. 15, tables 9. Washington, D. C., 1925.

In the bulletin are given the results of experiments with summer fallow, from 1917-1923 inclusive, at the Assiniboine Field Station. The climatic conditions during the above period were generally unfavourable to crops.

Land which lies over the season in a cultivated condition without, however, bearing a crop, is known as summer fallow; the system is chiefly confined to arid and semi-arid regions.

The soil, a sandy clay loam, on which the experiments were made is unirrigated land at an altitude of about 1600 feet. The average precipitation from 1880 to 1923 was 13.33 inches, but for the 7 year period of the experiments it was only 11.26 inches.

The yield of the wheat, oats and barley averaged higher on fallow than on disked maize fields or on land cropped continuously with small grain .

The total yields of maize (stover and grain) from fallow were about 1000 lb. more than with any one of the three best methods of continuous maize growing, but maize grown on spring ploughing, autumn ploughing, or subsoiling was produced more economically than that grown on fallow.

The yields of oats and winter wheat after green-manure crops were about half those after fallow.

Ploughing 8 inches deep for fallow was more profitable with oats, barley and winter wheat than ploughing 4 inches deep, or ploughing 8 inches and subsoiling 18 inches. Subsoiling gave higher yields of oats than 8 inches ploughing, but the increased yield was not enough to pay for the additional cost.

W. S. G.

[618-619]

620. **Spacing Experiments : a New Method.**

HARLAND, Prof. S. C. *Tropical Agriculture*, Vol. II, No. 3, p. 67. Trinidad, 1925.

The yield of a crop is mainly determined by the interaction of the two factors, yield per plant, and number of plants per acre. When a crop is introduced into a new country it is very important to ascertain the optimum number of plants per acre. For this purpose the author has devised a spacing technique which is easier to carry out than the method of plots, each devoted to different types of spacing.

The method consists in spacing the plants along a row in a series of gradually diminishing distances, for instance, from 30 inches at one end of the row to 3 inches at the other. The distance between the rows is kept uniform; other experiments may be made in which the distance between the rows is varied.

To ensure a smooth curve the mean yield of not less than 50 plants at each spacing should be taken, and if possible the probable error of each series calculated.

The results may be shown in a curve in which number of plants per acre is plotted against yield per plant and yield per acre.

The results will fall into a curve which will ascend until the optimum spacing is reached, and will fall as the spacing becomes too close.

Preliminary experiments indicate that the method may be of wide application. W. S. G.

Machines and Implements.

621. **Recent Innovations in Farm Machinery.**

BOND, J. R. *The Scottish Journal of Agriculture*, Vol. VII, No. 4, pp. 357-364, plates 2. Edinburgh, 1924.

Rotary Tillage. Various attempts have been made to devise a machine which would produce a fine tilth in one operation. The application of the principle of rotary tillage or fraizer work is attributed to MECHWART of Budapest, but the machine best-known to British farmers is that of SIMAR, made in Switzerland. In the Highland Society's trials in 1922 the report on the SIMAR Rototiller was as follows: On unbroken stubble the machine pulverised the soil thoroughly to a depth of 8 inches, and left a loose mould 10 inches deep. On dirty land the surface weeds were thrown out and left clean on the surface. It was considered to be a very useful machine for autumn cleaning of dirty land, but not suitable for grassland as the turf was broken up and left on the surface.

On soil in a suitable condition the machine extracts weeds and produces an ideal seed-bed in one operation.

The Rein Drive Tractor. This machine, made by Messrs. FOWLER of Leeds, has been developed in Australia. It is a two-wheeled tractor rigidly coupled to the implement that it is required to haul. By means of the reins the driver, who is seated on the implement at the rear, can cause

the motor to advance, back, stop, or turn. It is very handy for working in confined places. The driver has both the working implement and the tractor in front of him, also, he is free from the vibration and noise of the tractor.

W. S. G.

622. **Recent Developments in Oil Palm Machinery.**

EATON, B. J. *Malayan Agricultural Journal*, Vol. XII, No. 12, pp. 382-393. Kuala Lumpur, 1924.

The problem of the best type of machinery for the treatment of the oil palm fruit, involving the separation of the pericarp from the fruit and extraction of the palm oil from the pericarp, has been under consideration for some years. The author has studied the plant shown at the British Empire Exhibition and is of opinion that the problem has been solved satisfactorily.

The processes of Manlove, Alliot and Co., and Culley Expressors, Ltd., are fully described, with details and cost of plant. The essential differences between the two processes are that, in the former the whole fruit is treated direct in the centrifugal extractors after digestion with steam at low pressure, whereas in the Culley process the pericarp is first separated in a special machine, after the fruit has been heated in a digestor, with no direct contact of steam. From actual experience with palm fruits treated either with boiling water or low pressure steam, the author does not considr that decomposition of the oil is likely to result from contact with low pressure steam.

The treatment of pericarp alone in the Culley centrifugal extractors gives a larger output from these machines, since the nuts are not introduced, but an extra operation, that of depericarping, is involved, which requires a special machine.

W. S. G.

RURAL ECONOMICS.

623. **The Importance of the Cultivation of Roots in the Organisation of Farming.**

MEUNZINGER (Hohenheim). Die Bedeutung des Hackfruchtbaues für die Betriebsorganisation, *Mitteilungen der D. L. G.*, XL Year, No. 11. Berlin, March, 1925.

High cost of labour, low prices of farm products, lack of working capital and credit, are characteristic of the present condition of German agriculture. It is not surprising that many farmers, owing to the necessities of the moment, try to force their soil to yields more, even if by this expedient they damage the future prospects of their farms.

The author's object is to show that the cultivation of roots, though the cost of labour is more and the return less than more extensive crops, is yet absolutely indispensable for the general good of all the crops in the rotation and that without roots the other crops will produce less.

The author shows by means of tables the average cost of production for each crop grown on the farm of the Agricultural High-School at Hohenheim over a period of 30 years. As a unity of measure for the work done he does not employ monetary unities but "normal men-days" (Woman's work = $^3/_4$ man's day) and "normal horses'-days" (4 oxen = 3 horses).

Costs of production per ha. in men-days and horses-days.

Roots	121	[illegible]
Rape and leguminous plants.	61	30
Wheat.	[illegible]	[illegible]
Meadow-land	25	11

It is seen from this that roots require more labour, both from man and team and that the cost of roots is three times as high as for corn.

Labour is no doubt to-day the greatest expense in farming; after it comes manuring. Here too, roots are the most expensive of all, rape and leguminous plants occupy the second place, corn the third and meadow-land the fourth.

The author then considers the cost of the seed of the different crops, in which relation also, potatoes with a cost five times as high as that of wheat present an unfavourable result.

The costs are compared with the gross monetary returns. Over an average of 30 years at Hohenheim there were harvested; 27.3 double quintals of wheat; 27.0 double quintals of oats; 175 double quintals of potatoes; 300 double quintals of sugar beets. If the total cost is compared with the rough produce, it results that the relation of cost to gross return of money is:

Crop	Total cost	Gross return	Excess of returns over cost
Wheat.	352	630	278
Oat	320	472	152
Potatoes	854	918	64
Sugar beets	836	960	124

It must be stated that the Hohenheim soils are decidedly corn soils and are not good potato soils, which makes the results somewhat unfavourable to the latter.

The data show that the cost is so high with roots that, if marketable products only are considered their gross profit remains far behind that of cereals, particularly wheat. The difference becomes still more

unfavourable, when the relation of expense to gross profit surplus is considered, for example:

Wheat	100 : 79
Oat	100 : 48
Potatoes	100 : 8
Sugar beets	100 : 15

Hence, wheat and oats, with a minimum of risk and the smallest expense, yield a relatively the largest surplus. But they are only favourable — and therein lies the invaluable character of root-crops, which does not appear from the figures — when corn is grown in rotation with roots. If the influence of roots were eliminated, such high yields for wheat and oats (an average of 31.5 double quintals, relatively 33.7 double quintals in the last 12 years) could never be attained. The result would then be quite different, for without roots the soil would need such quantities of artificial manure, that it would soon be impossible to increase the yield of cereals by forced increase of artificial manuriug.

Replacing the expensive potatoes or the sugar beets by rape or leguminous plants does not have so good an effect, nor is the result so certain. Laying down a large extent of land to grass is only advisable where the soil makes such a course necessary. To change good arable land into meadow land would be short-sighted and would alter the general relation of prices, to the disadvantage of cattle production, to which the farmer who had followed this policy would turn.

In considering the unfavourable figures shown actually by roots, one must not overlook the advantages to other crops of the cultivation of roots and therefore the words of RUMKER concerning the cultivation of roots are still perfectly justified: "The cultivation of roots is the base and the lever for the introduction of a higher and more intensive cultivation of the soil, for larger yields of the land and an increased production of cattle. It is the high school of modern intense agricultural development and hence one of the most important factors of the possibility of supplying by our own production our requirements of bread and meat. Whosoever raises the axe against this point and damages this base of our existence, does us a vital injury".

H. I. H.

624. **A Study of Farm Organization in Central Kansas.**

GRIMES, W. E., HODGES, J. A., NICHOLS, R. D., and TAPP, J. W. *United States Department of Agriculture Bulletin No.* 1296, pp. 74, figs. 31, tables 35. Washington, D. C., 1925.

The authors have made an intensive study of the organization and working of a number of representative farms. The information obtained forms a basis for judging the suitability of different combinations of enterprises, deciding which combinations should prove most profitable under varying market prices conditions, and indicating how efficiency in the different operations may be attained.

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The area selected is described, labour and material used in crop and livestock production are discussed. The principles governing choice of farm enterprises are dealt with, and the application of these principles.

Various aspects of the problems discussed are illustrated by graphs.

W. S. G.

625. **Agricultural Valuations.**

BORDIGA O. (Professor of Rural Economy and Valuation and Agricultural Accountancy at the Royal High School of Agriculture at Portici). *Trattato di stime rurali* (Treatise on Agricultural Costings). 3rd and completely revised edition. Vol. I, p. IV + 436, 1923; Vol. II, p. IV + 396. E. Della Torre, Portici, 1923.

The third edition of the work of Prof. BORDIGA was eagerly awaited, as the two previous editions (1891-3 and 1907-11) were out of print. It is distinguished by: the bringing up to date of the information given, in which full account has been taken of the economic phenomena which began after the war and of recent legislation on the subject in Italy, accompanied by figures and methods of valuing; by the more extended information preparatory not only to the making of valuations, but also to the investigation of farm management as applied to the most extended form of agriculture; by the concise but complete description of the economic-agricultural conditions of the various regions of Italy, of which half a century's teaching and professional experience has given the author a profound knowledge, enabling him to indicate the sources of all the information supplied under this headings.

After some chapters treating of the history of Valuation and its general principles, the author, in Vol. I, deals with: Agricultural, agricultural-industrial and livestock products; market prices; the yield and cost of human, animal and machine labour; farm management. Vol. II: Methods of making valuations, valuation of land with a view chiefly to purchase and sale. Methods of valuing landed estate; valuations in various public and private interests; valuations of land under permanent cultivation; forest valuation; estimations regarding water, improvement of land, damage caused by hail, fire, industrial contaminations, etc.

Each volume concludes with an alphabetical analytical index and a numerical index.

The work is especially intended for surveyors and valuers, those holding degrees in agricultural science, civil engineers and scientific agriculturists, teachers of agriculture and valuation, students of economic-agricultural management, proprietors, and managers of country estates.

F. D.

626. **The Profit Yielding Capacity of Farms with Regard to Recent Valuation for Income Tax of Agricultural Properties, Large, Average Sized and Small.**

ROTKEGEL W. Die Rentabilität der landwirtschaftlichen Betriebe mit Rucksich auf die jungste Einschätzung der landwirtschaftlichen Gross,

Mittel und Kleinbetriebe zur Vermögensteuer. *Jahrbücher für Nationalökonomie und Statistik*, Vol. 122, No. 5. pp. 634-639. Jena, 1924.

In the article the author emphasizes the fact that the valuation of agricultural holdings according to the returns only, cannot be considered as sufficient, the size of the holding has also an important bearing on the net return. He shows that the net return per unit of area of equal quality may be much higher with a small holding than with a large. This is already clear from the fact observed when land is bought or rented, viz. that the price per hectare of a small holding is much higher than that of a larger one.

When it is remembered that the self supporting agricultural holdings of large or average size predominate everywhere with the leading civilised nations, it is clear that it is not enough to estimate the yield of holdings without taking account of their category. A great difference of opinion however exists as to the size which is economically the most advisable. AEREBOE has summed up the essential point of the question in the following remark quoted from his " Allgemeine landwirtschaftliche Betriebslehre " : " From a point of view of the advantage of the individual there is no such thing as an absolute superiority of large, average-sized or small property. This superiority on the contrary varies in each case according to market conditions and according to natural and particularly personal circumstances ".

H. J. H.

627. The Cost of Production of the Sugar Beet in Hungary.

PRACK, L. (Landesinstitut für landw. Betriebslehre, Budapest). *Wiener landwirtschaftliche Zeitung*, Year 75, No. 6054. Vienna, 1925.

The author gives an account of the change in the working conditions in connection with the cultivation of sugar beets during the post-war period and shews by means of a table the increase of the cost of production for each item of working expenses, to which corresponds a fall in the prices given for the crop produced.

The total cost of production for sugar beets before and after the war is shewn by the following table :

Cost of production per " Kadastral yoke " (1).

	Before the war			In 1924		
Yeld of beets (taken as)	100	150	200	100	150	205
In current money	2.08	1.42	1.50	49200	25226	25290
In gold values	2.08	1.42	1.10	2.90	1.95	1.48

Before the war the average price obtained for the sugar beet was 2.20 Austrian crowns, so that production would pay, even with a gross

(1) A " Cadastral yoke " = 0.57 546 ha.

yield represented by 100. Nowadays the Hungarian factories pay only 30,000-32,000 Hungarian crowns, at which price only the highest yields are remunerative. H. J. H.

628. **Transport in Tropical Africa.**

BRACKENBURY, R. H. *Journal of the Royal Society of Arts*, Vol. LXXXIII, No. 3776, pp. 464-486. London, 1925.

Transport in tropical Africa is largely a question of how to bring agricultural and other raw produce from the interior down to the coast for shipment, and on the other hand, how to send manufactured goods to the interior. The problems depends upon the cost per ton-mile, and the author shows that there is a vital gap to be bridged between the potential producer of the world's foodstuffs and raw materials in Tropical Africa, and the arterial lines of the world's communications. The gap comes between the primitive native methods and the highly specialised railway systems. The cost of railway transport per ton-mile decreases as the quantity carried increases, whereas with primitive methods of transport the contrary is the case: as quantities increase, so also the cost per unit increases.

A railway cannot be constructed to carry small quantities of produce economically. At present in many parts of Africa there are only two alternatives — porters to carry a few tons, or a railway to carry thousands of tons. It requires about 40 men to carry one ton of produce, and to transport 100 tons per month over a distance of 100 miles will need 2000 men. Apart from economic objections, such numbers of carriers are not available. To carry 1000 tons per month from a point far inland, by men, packs-donkeys, camels or even ox-wagons is not practicable. On the other hand, it would be a doubtful venture to build a railway for such a quantity.

Light railways in Africa can hardly be built for less than £5000 per mile; the cost of the railways of Nigeria is given as £11 000 per mile.

Pack transport, or wagons, are more efficient than men as carriers, but over very large areas the use of animals is excluded by the presence of the tsetse fly. Hence, the solution of the problem cannot be found in head porters, pack animals, or ox, or mule wagons.

Another suggestion is that of macadamized roads for heavy motor wheeled traffic, but the tropical vegetation and torrential rains make the maintenance of such roads over great distances, impracticable.

The author advises that unmade roads should be cut, radiating from railway stations, and that large sums of money should be spent only on building substantial bridges and drains.

With reference to motor traffic, the various types are dicused, such as the ordinary, solid type lorry, the six-wheeled Albion lorry, the Renault six twin-wheel car, etc. The caterpillar-track type is then treated, such as the Diplock Pedrail, the Guy Lorry, now being tested by the Empire Cotton Growing Cooperation, the Sentinel Roadless Tractor, and the Citroen Kegresse.

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In the opinion of the author, it is by the use of these track vehicles that the «economic gap» will be bridged in the transport systems of Tropical Africa, as that type of motor alone is adapted for carrying heavy loads over unmade roads.

The solution of this problem is of vital interest with regard to the development of agriculture in all tropical countries.

W. S. G.

AGRICULTURAL INDUSTRIES.

Plant Products.

629. Cold Concentration of Vegetable Solutions and new Applications of Refrigerator Plant in Enology.

MONTI, E. *Report of the III National Congress on Refrigeration*, pp. 1-16, 1 plate. Milan, 1924.

For the concentration of solutions, especially if they are very liable to change (as regards delicate aromas for instance), the author uses the condenser and mechanism of a refrigerating machine, which by utilising the machine to the utmost enables him to attain his object. In the States this apparatus is used in the establishment at Ukiah (California) in the preparation of grape extract, the yield being 40-43 kg. of water separated for every kg. of heavy oil burnt in the motor.

The method may be applied in other ways, for instance, it is possible not only to preserve, but also to improve, or rather intensify, the aroma. This may be done in the case of the tomato in the preparation of the concentrated liquid.

Refrigeration may be extensively applied in enology, as it serves to stabilize wines and liqueurs, for which purpose however it is also necessary to oxidise previously all substances capable of being so treated which are contained in them. The process also serves to artificially age wines, in which it leaves, even in an improved state, the whole bouquet.

By this means also an extract of the bouquet of the wine may be prepared from the grape residues, which extract also contains the colouring matter, enzymes and vitamines. The process may be applied in numerous ways, either for a more scientific preparation of wines with a low degree of alcohol, which retain their colour and bouquet, or for the better utilisation of the residues, or again for intensifying the flavour and aroma of fruits in general.

A. F.

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636. **Dried Beet Slices and Beet Flour.**

HOC P. Les cosettes sèches et la farine de betterave. *Journal d'agriculture pratique*. Vol. 1, No. 9, pp. 170-173. Paris, 1925.

The beet, transformed into dried, unalterable slices, forms a very concentrated, easily transportable feed, and one which is easily assimilable and keeps well. The dried slice is especially rich in sugar, which it yields at the lowest possible price and in the form most appreciated by livestock.

Average composition of dried slices.

Water	13.80 %	Carbohydrates	8.66 %
Sugar	59.40 %	Cellulose	4.99 %
Nitrogenous matter	6.95 %	Ash	5.81 %
Fats	1.65 %		

Horses fed on dried beet slices instead of oats, 3 kg. of dried beet slices replacing 5 kg. of oats, retained their vigour, doing the same amount of work and increasing in weight.

In practice the slices should be substituted gradually, litre per litre, that of the beet slices weighing 300 gm. as against that of oats weighing more than 500 gm.

The dried beet slice is also equally suitable for working oxen and store cattle. For working oxen, hay, beets and cake have been successfully replaced progressively by 7 kg. of beet slices, plus 3 kg. of bran. It is well however to utilise the slices as a supplementary feed in quantities of 600 gm. for store cattle per 100 kg. of live weight. Beet slices used as a pig feed give excellent results : live weight increases very rapidly and the meat is superior in whiteness and flavour.

The pigs are very fond of the slices and consume them without the least hesitation during the whole period of fattening. For store sheep, the beet slice is a perfect feed, bringing them to the desired point of fattening and imparting an agreable flavour to the meat.

Given in moderate quantities the beet slice has a good influence on lactation and the milk's richness in fat content.

Beet slices prove superior and more economic in use than the other feeds sweetened or treated with molasses.

% Composition of beet flour.

Albuminoids	6.00 %	Fat	0.75
Saccharose	65.50	Water	6.40
Carbohydrates	12.75	Residues, saline, inert matters	3.40
Saccharifiable cellulose	5.20		

The beet slices are placed on a tray and treated with steam mixed with unsaturated hot air ; the heat coagulates the albuminoid substances of the protoplasm, the cells allow the water they contain to evaporate, and on the next trays they are subjected to a strong current of air, less and less charged with steam and of increasing heat.

Sugar beet meal may be mixed with groundnut cake, cotton, coconut and linseed cake, which are too poor in carbohydrates in proportion to their nitrogen content, of which it increases the sugar content, rendering them more digestible.

The meal will keep for an indefinite period without alteration.

A ton of beets gives 250 kg. of meal.

P. D.

631. **The Physiology of Apples as related to Storage.**

I. — HAYNES, D. (Department of Plant Physiology and Pathology, Imperial College of Science and Technology, London). Chemical Studies in the Physiology of Apples. Change in the Acid Content of Stored Apples and its Physiological Significance. *Annals of Botany*, Vol. XXXIX, No. CLIII, pp. 77-96, figs. 8. London 1926.

II. — ARCHBOLD H. K. The Nitrogen Content of Stored Apples. *Ibidem*, pp. 97-107, figs. 2.

III. — *Idem*. The estimation of Dry Weight and Amount of Cell Wall Material in Apples. *Ibidem*, pp. 109-121, figs. 3.

The different varieties of apples contain varying quantities of acid, from a minimum of 0.15 %, calculated as malic acid, for the « Sweet Alford » variety, to a maximum of 1.5 % in the « Bramley's Seedling ». In spite of these considerable initial differences, after having been stored for a certain time all the apples have very nearly the same acidity, which is rarely more than N/50. There is no doubt that such changes, accompanied by changes in hydrogen-ion concentration, influence metabolism and are an index of those processes of breakdown which come under the name of senescence.

The effects of storing at low temperature are a decrease of the rate of loss of acid and an increase in the fluctuation of the acid content. The loss of acidity follows a course which may be expressed by a logarithmic law, expressed by the formula : log. $C = b\text{-}at$, in which C is the acid concentration in mg. per 100 cc., *b* the logarithmic value of the acidity titration at the date of picking and *a* measures the rate at which the acidity declines.

Deviations appear to arise from immaturity, when the apple is picked too early, and to internal breakdown during cold storage. If, on the other hand, the apples are stored at 15° instead of 1°, the actual curve very closely follows the logarithmic law ; as a matter of fact, then, the loss of acid is much greater than it seems to be, since, at a higher temperature, there is a loss of water through evaporation (which is quite negligible at 1°), hence there is a greater acid concentration.

In cold storage there is, in general, a direct relation between high acidity and internal breakdown, so that the latter may be avoided by exposing the apples to low temperatures only when the acid content has been reduced. On the contrary the higher the acid content at the time of picking and the slower the loss of acidity, the more favourable are the conditions for internal breakdown.

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The physiological breakdown is accelerated by a low temperature under conditions which maintain a high acidity, at the same time retarding the breakdown of the cell-walls, so that storage at a low temperature would bring about conditions for a premature internal breakdown.

The course followed by the process of disintegration of the cell-walls is probably determined by the hydrogen-ion concentration ; it is therefore well to titrate the juice 2-3 times during the first weeks of storage. The logarithmic curve thus obtained shows the time required to arrive at a given acidity concentration, of which the minimum compatible with a satisfactory state of the apple is 10 mg. per 100 cc. in the " Bramley's Seedling " variety. A disposition towards rapid breakdown is also shown by an abnormal course of the curve, combined with high acidity.

During storage at a temperature of 1-3°, there is a decrease in the nitrogen content of the apple, and as it contains no substances which indicate protein degradation, it must be concluded that the protein undergoes oxidisation, this leading to the formation of nitrites or nitrates. The apple contains nitrogen in the form of protein, of which only traces are soluble ; the quantity of nitrogen is 0.02-0.08 %.

A correlation is observed between nitrogen content, acidity and the degree of respiration of individual apples, inas much as a high nitrogen content is related to low acidity and high respiration.

As regards the weight of dry matter, the author observed that it remains appreciably constant at 1°, whereas it diminishes when the apple is kept at a temperature of 3°. The effect of the low temperature is either to slacken the speed of chemical reactions or, especially, to alter their nature.

A. F.

632. **Problems of Apple Transport Overseas.**

KIDD, Dr. F. and WEST, Dr. C. *South African Journal of Industries*, **Vol. VIII, No. 3, pp. 193-201. Pretoria 1925.**

The article embodies the chief points of the special Report (No. 20), drawn up by the authors, of the Food Investigation Board of the British Department of Scientific and Industrial Research, and contains the results obtained by the scientific expedition sent to Australia in 1923.

The Australian apple export season of 1922 was a record, but of a total of 2,000,000 cases, over 500,000 arrived in England in a severely damaged condition, the loss caused by damaged fruit being estimated at £250000 for the whole season ; these losses were largely due to brown heart.

The problem of ventilation. It had already been found that English apples would develop brown heart on cold storage, under conditions such as would allow an accumulation of the carbon dioxide produced by the apples by the process of respiration. The knowledge was utilized and ventilation methods were adopted in ships in 1923, with the result that brown heart occurred in two cases only of that season's shipments.

Investigations respecting the occurrence of brown heart before shipment gave negative results. It was proved by experiment that apples subjected to insufficient ventilation in transit will develop brown heart,

and that removal of those conditions will avoid all danger of the disease developing during a voyage.

The amount of ventilation necessary depends upon the rate of carbon dioxide formation in the ships' holds, and this depends mainly upon : the weight of apples present ; the inherent respirating activity of the apples ; the temperature of the apples. The amount of carbon dioxide likely to be formed per ton per day is only about 2.5 cu. feet, at a temperature of 35° F. ; with 1 % carbon dioxide in the hold the amount of ventilation must be sufficient to remove about 250 cu. feet of air per day per ton of apples.

Accidental ventilation often occurs, and this has been responsible for the safe carriage of cargoes in the past where no intentional ventilation had been given.

The problem of temperature control : The length of life of apples in cold storage is prolonged by a reduction of temperature, due to two cases : (1) a redardation of ripening ; (2) the checking of mould development.

The best conditions as regards temperature are : cooling the fruit to 32° F.-34° F. with the least possible delay after gathering, and the maintenance of a uniform temperature of 30° F.-34° F. throughout the voyage.

The difficulties increase in proportion to the bulk of cargo carried and the size of the hold.

The results obtained by the expedition show that in large holds none of the systems in use attain a uniform temperature throughout the cargo after cooling.

W. S. G.

633. **Marketing and Distribution of American-Grown Bermuda Onions.**

STEVENS, W. M. *United States Department of Agriculture, Bulletin*, No. 1283, pp. 55, figs. 14, tables 11. Washington, D. C., 1925.

The author discusses the extent of the onion industry, the producing areas, varieties, production, distribution, methods of sale, transport charges, market prices during 1916-1923, factors influencing prices, and con, cludes with the official description of the United States Grades for Bermuda onions, with descriptions of the grade terms.

W. S. G.

634. **The Vitamine Content of Fungi.**

STEIDLE, H. (Pharmakologisches Institut der Univers. Würzburg). Besitzen essbare Pilze antiskorbutische Wirkung? *Biochemische Zeitschrift*, Vol. CLI, Nos 3-4, pp. 181-186, figs. 2. Berlin, 1924.

Contrary to what has been asserted by other authors, the edible fungi *Cantharellus cibarius* and *Psalliota campestris* do not contain the antiscorbutic vitamine C. The tests were made on fresh fungi.

A. F.

635. **British Guiana Woods for Paper Making.**

Bulletin of the Imperial Institute, Vol. XXII, No. 1, pp. 14-25. London, 1924.

The thirteen specimens of the timber and palm stems the report of which forms the subject of the article were sent to the Imperial Institute, London, for examination as to the value for the manufacture of paper pulp.

Details of each wood are given in the article; the results obtained are summarised in the following table:

Local Name	Botanical Identity	Parts of caustic soda consumed per 100 parts of material containing 12 % moisture.	Yield of dry unbleached pulp expressed on material containing 12 % moisture.
		%	%
1) Bara-bara	*Diospyros guianensis*, Gürke (Ebenaidae)	14.3	48
2) Baramalli	*Tubebuia* sp.? (Bignoniaceae)	13.1	42
3) Fotui	*Jacaranda Copaia*, D. Don. (Bignoniaceae)	11.3	53
4) Haiari-balli . . .	Leguminosae)	11.4	45
5) Hubu (Hog Plum)	*Spondias lutea*, Linn. (Anacardiaceae	15.3	41
6) Hurowassa . . .	*Pithecolobium trapezifolium* Benth. (Leguminoseae). .	12.5	42
7) Karahora	*Schefflera depressa*, Sprague, n. sp. (Araliaceae)	12.0	51
8) Kurukoruru . . .	*Diplotropis* sp.? (Leguminoseae)	11.9	43
9) Long John . . .	*Triplaria surinamensis*, Cham. (Polygonaceae)	13.9	40
10) Wanasoro	*Cecropia Juranyana*, Richter (Moraceae)	14.3	40
11) Manicole	*Euterpe edulis*, Mart. (Palmae)	15.1	40
12) Ite (Aeta). . . .	*Mauritia flexuosa*, Linn. (Paluiae)	12.8	28
13) Mukka-mukka . .	*Montrichardia arborescens*, Schott (Araheae).	14.6	30

From these results it is seen that the first ten woods, give on the whole good yields of paper pulp. The pulps bleached satisfactorily and could be used, in most cases, for the manufacture of paper of good quality. Wood No. 11 (Manicole) is less valuable and the last two would not be worth exploitation owing to the low yields of pulp given. Ite also gave a paper of inferior quality.

W. S. G.

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636. **Investigations of Paper Making Materials.**

Bulletin of the Imperial Institute, Vol. XXII, No. 4, pp. 418-433. London, 1924.

In the article is given an account of the results of examination of materials sent recently to the Imperial Institute, London, in order to ascertain their suitability far paper-making.

Bamboo from Mauritius. This is a small variety of bamboo, thought to be *Bambusa nana*; the yield from an experimental area was about 20 tons of stems per acre. The pulp produced was equal in quality to that of *Bambusa Tulda*, but the yield was somewhat lower.

Elephant Grass from Sierra Leone. The material consisted of stout grass stems which yielded a readily bleachable pulp, producing a strong paper of good quality

Bardy Reed from Iraq. The pulp did not bleach well and is not a promising paper-making material.

Costus afer from Uganda. The investigation showed that the yield of pulp from *Costus afer* is satisfactory, being similar to that of esparto grass. The pulp felts well and gives a good quality paper, bleaches well and then yields a strong white paper suitable for writing and printing papers.

Amomum Granum-Paradisi from Uganda. Closely related to *Costus afer*, produced a pulp that bleached with some difficulty and yielded a hard, though, "rattly" paper, suitable for writing and printing papers.

Abutilon tortuosum from South Africa requires a high consumption of soda and gives a low-yield of pulp, but felts well and produces a good quality paper.

Waste Cotton Bells from Egypt. The original material yields a pulp which can be made into brown wrapping paper, or after bleaching can be used for producing cream-coloured paper. The opinion expressed was that this material could not be used for export unless clean, white cotton could be obtained from it. An engineer stated that it would be very difficult to devise a machine to extract clean lint from the bolls, and that it could be used profitably only in Egypt for the manufacture of brown wrapping paper.

Arrowroot refuse from St. Vincent. The investigations showed that this material has a low-value for paper-making. W. S. G.

637. **The Diagnosis of Decay in Wood.**

HUBERT, E. E. *Journal of Agricultural Research*, Vol. XXIX, No. 11, pp. 523-567, plates 11, figs. 6, tables 5, bibliography. Washington, D. C., 1924

Many of the industrial problems connected with the staining and rotting of wood could be more satisfactorily dealt with if a reliable means were available for the identification of the fungi which cause decay in wood and wood products.

The author has made an exhaustive study of the subject and in the

article describes methods for the diagnosis of decays commonly found in wood, together with notes on a number of wood-destroying fungi of economic importance.

A classification under two main groups of white rots and brown rots is given, according to gross characters.

The methods for diagnosis are given under three main divisions: gross, microscopical, and cultural characters. These when determined are considered to supply sufficient data for identification of the causal organism.

A complete diagnosis will decide whether or not decay is present and whether the causal organism is alive or dead, and will give data as to the fungus.

The use of the diagnostic methods described will supply data of scientific value for the solution of problems relating to the staining and rotting of wood. W. S. G.

Animal Products.

638. **The Gerber Method for Determination of Fat in Milk.**

ANDERSEN, A. C. et WINTHER J. E. Om Gerbers Metode til bestemmelse af feat in moelk. — 116. *de Beretning fra Forsøgslaboratoriet*, udgivet af den kgl. Veterinaer-og Landbohojskoles Laboratorium for landøkonomiske Forsøg, p. 1. 66, 6 tables, 1 fig., Copenhagen, 1924, (received 1925).

In the 115th report from the Experimental Laboratory was mentioned the application of the Gerber-van Gulik's method for determining fat in cheese, and also examinations, which showed that the percentage of fat found was less in conformity with the analysis by weight as the cheeses decreased in quality. These results have now led to the re-testing of the *Gerber acidbutyrometrical method* itself, and it is these very thorough examinations which are mentioned in the 116th report and from which the following chief points are reproduced:

1. *The classification, etc. of the butyrometers.* A statement is given of the cubic content of the butyrometers, and of the chief results these may be quoted: "It is taken for granted that the butyrometers are classified on the supposition that all fat present in the milk is freed and that it is freed in pure state. Though this last mentioned supposition may not be perfectly correct, the alterations taking place in the milk fat by the Gerber process are of so little importance that they do not influence the result".

2. *Determination of Fat in Milk.* — The chief principle of the Gerber method is that the protein matters of the milk are decomposed by means of strong sulphuric acid; this process disengages the fat which, after the addition of amyl alcohol, combine on being treated in a centrifugal consisting of a divided tube in which its volume and hence its quantity is shown. 10 cc. of sulphuric acid, 11 cc. of milk and finally 1 cc. of amyl alcohol are measured. The measuring must always take place in the order: sulphuric acid, milk, amyl alcohol. The milk must be slowly run out of the pipette and down the wall of the butyrometer, so that it may form a

layer over the sulphuric acid. The milk from which the 11 cc. is taken must be well mixed.

3. — *Exactitude in the determination of fat in whole milk.* — The investigations proved that, by careful manipulation in determining fat in whole milk by means of Gerber's method, results may be obtained which on an average in 72 % of all cases deviate no more than 0.05 % fat, and on an average in 95 % of all cases no more than 0.1 % from that found by the actual laboratory method (Rose-Gottlieb's method).

4. *The influence of various factors on the exactitude.*

a) The strength and quantity of sulphuric acid. — The directions say that its specific gravity must be 1.820-1.825 at 15°C, corresponding with a content of 91 % of pure sulphuric anhydride. By the experiments, sulphuric acid with a specific gravity of 1.825, 1.80, 1.75 and 1.70 has now been tested, the three first mentioned giving the same results; by the application of acid with a specific gravity of 1.75 there was coagulation which complicated the reading. Acid with a specific gravity of 1.70 could not be used as the casein did not dissolve, nor was the fat clearly freed. It is essential that the sulphuric acid should be protected against absorption of water, which may easily be prevented by taking care that the bottle is never left without a stopper, which must be of glass or rubber, the former by preference.

b) Amyl alcohol. — Gerber states that this must have a specific gravity of 0.815 at 15°C. and distil between 128 and 130° C. The investigations showed that the amyl alcohol may deviate considerably from the demands made by Gerber as to specific gravity and boiling point, and still be perfectly suitable. In controlling its efficiency the chief points therefore must be the results of comparative determinings of fat, not the physical character of the alcohol. An alcohol that will disengage drops of oil in the blank experiment made with water instead of milk, as suggested by Gerber (described in the report) is useless.

c) The temperature and duration of the water-bath. — Gerber states that the prepared samples must never be left for more than fifteen minutes at 60-70° C. before they are treated in the centrifugal machine, as otherwise "stoppers" may easily appear where the sulphuric acid and the fat column meet, which statement was confirmed by the experiments. After having been treated in the centrifugal machine the samples must be placed in the water-bath to be heated to 65° C. before the reading can take place, the scale in the tube being intended for fat at this temperature. Experiment showed that the samples are able to stand for a longer period at that temperature without any bad effects being visible; an alteration of 1°C. in the temperature while standing, for each cc. gives an alteration of only 0.0008 cc. or 0.08 % of the quantity of fat, which means that in milk with 5 % fat an error of 12.5° in the reading of the temperature will only give an error in the reading of 0.05 % fat.

d) The state of the milk samples. — Neither the addition to the milk sample of formalin nor potassium dicromate will prevent certain milk after standing rather a long time, undergoing alteration, *i. e.*, some part of the milk decomposes. Experiments showed that the Gerber method

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may give correct results even though the fat is partly decomposed. By the examinations of poor milk, the fat of which was partly decomposed the method in most cases gave too low results.

e) The fat percentage of the milk samples. — The experiments proved that while the Gerber method, when applied on ordinary whole milk, gives fair results, it gives generally, when applied on very high percentages of fat, somewhat too high results; with very low percentages of fat the results are ordinarily a good deal too low if the special method is not applied, and even with the butyrometers, which are specially constructed for very poor milk, the average result is a little too low.

On the whole, however, it may be said, as already mentioned in the 61st report from the Laboratory, that when a carefully treated Gerber sample can be read with certainty, the results will always be sufficiently accurate for practical requirements.

The determination of fat in cheese by the Gerber-van Gulik method (Butyrometer for 15-20 % fat). — As already mentioned, it appeared that after the introduction of the cheese control at the Experimental Laboratory that the fat percentages found by the Gerber-van Gulik method generally are less accurate, as compared with the analysis by weight, as the cheeses become poorer in quality. The reason must be sought in the fact that the cheese fat, unlike the milk fat, is nearly always somewhat acid; the free fatty acids combine with the amyl alcohol to form sal alcyl which has a fruity smell and is flung out by the centrifugal machine together with the fat, not entirely, however, to the same degree. Irrespective of the fat percentage in the tested sample, there will always be the same quantity of sulphuric acid in the butyrometers; the quantity of amyl alcohol-fatty acid combination which is able to remain dissolved in the sulphuric acid, therefore, under all conditions is the same, and expressed as a percentage of the fat is greater, the smaller the quantity of milk. It is therfore to be expected that for the same degree of decomposition of the fat, the probability of obtaining low percentages will increase with the decreasing percentage of fat. By working with various milk samples in which the percentage of milk as well as the degree of decomposition, were different, it is found that the Gerber method, compared with the Schmid-Bonzynski-Ratzlaff method for milk with less than 2.5 % fat, gave too low results, the results being lower as the milk became more decomposed; this was still more evident in milk with less than 1 % fat. (Corr. Denmark).

630. **Additional Information on the Influence of Foot-and-Mouth Disease on Milk and especially on Production.**

PROKS, J. (Institut lactologique de l'Ecole polytechnique de Prague). Contribution à la connaissance de l'influence de la Fièvre aphteuse sur la formation du lait, surtout de la matière grasse. *Le Lait*, Year 4, Vol IV, No. 40, pp. 830-840, 5 figs. Lyons, 1924 (received 1925).

The samples of milk analysed were taken from sick cows in different parts of Bohemia; one sample came from Central Moravia. In certain

cases the disease was not serious, in others it had reached an acute stage. The object of the analyses was to determine the total dry solids, fat, lactose, total nitrogenous matter, and ash.

The rest of the milk, after total analysis, furnished cream from which butter was made in order that the quality of the milk fats could be estimated. The following values were determined: refraction, REICHERT-MEISSL, WAUTERS POLENSKE, saponification, iodine and finally the SAVINI or corrected acetic.

In every case the results were controlled by repeating the same determinations on milk from the same animals when cured. The following conclusions may be drawn from the results of these determinations:

(1) During milk formation, the influence of foot-and-mouth disease may show itself by such changes that the quantity of undetermined constituent, expressed, in the complete analysis of the milk by the difference between the total dry solids found and the total of the principal constituents, is greatly exaggerated; in other words, the samples of milk show a comparatively large difference between the total dry matter and the sum of the principal constituents.

(2) The index of refraction of the fats rises.

(3) The REICHERT-MEISSL index is much lower than for the fats in normal milk, which indicates a comparatively low percentage of soluble volatile acids.

(4) The WAUTERS POLENSKE index is often very high, indicating an abnormally high insoluble volatile acid content.

(5) The saponification index is somewhat lower, this reduction corresponding with that of the REICHERT-MEISSL index, but in every case it remains within normal limits.

(6) The iodine index was remarkably high, indicating that the fats in the milk of cows attacked by foot-and-mouth disease have a very high non-saturated acid content.

(7) The SAVINI or corrected acetic index was found to be very high, indicating that the solubility of the milk fats in acetic acid decreases.

To summarize: butter made from the milk of cows attacked by foot-and-mouth disease may be thought to be adulterated by the addition of coconut oil, judging from the REICHERT-MEISSL and WAUTERS POLENSKE numbers; it differs, however, from butter thus adulterated in its refraction, iodine and SAVINI numbers.

P. D.

640. **The Contamination of Water used in the Milk Industry and its Sterilisation by Ozone.**

SALMON (Inspecteur départemental d'hygiène des Deux-Sèvres). La contamination des eaux utilisées dans l'industrie laitière et leur stérilisation par l'ozone. *Le Lait*, Year 4, Vol IV, No 36, pp [illegible]5. Lyons, 1924 (received in 1925).

In the milk industry it is well to use for the washing of butter and cleansing of apparatus only water possessing the physical, chemical and bacteriological characters of the best drinking water. As regards bac-

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teria, the number of organisms, even liquefying bacteria contained in water does not much matter; the nature of the bacteria and the relative proportions of some of them are of more importance: the presence of *Bacterium coli*, *Bacillus lactis aerogenes*, *Bacillus pyocyaneus*, *Bacillus proteus* or *enterococcus*, is a sure sign that the water is contaminated.

Among the species indicating certain contamination, there are some which, incorporated into butter, give it an ill flavour or hasten rancidity: *Micrococcus prodigiosus*, *Bacillus fluorescens liquefaciens*, *Bacterium coli*, *Bacillus aerogenes*. The waters used, even those found to be of good quality, should constantly be controlled by periodical bacteriological analyses.

The author examines in detail the question of residuary waters in the dairy, and observes that their being poured away on an unsuitable waste ground or especially down an absorbent cesspool, is one of the most frequent and serious causes of the contamination of waters used in the dairy.

It is therefore well to sterilise the water before use. Sterilisation with ozone is advisable, for it is effective, practical, economical, does not introduce any foreign matter into the water and modifies neither its chemical composition nor organoleptic characters.

The author describes an apparatus for sterilising water with ozone. This apparatus comprises:

(*a*) an ozone producer or tubular ozoniser,

(*b*) a system for circulating ozonised air,

(*c*) a steriliser in which the ozonised air is brought into contact with the water to be sterilised.

To ensure effective sterilisation, a sample of the water is taken as it issues from the steriliser and a starch potassium iodide reagent is added to it. If the sterilisation is good the water immediately gives a more or less intense blue colouring. Sterilisation with ozone is the most hygienic and the surest method.

Butter washed with water properly treated with ozone keeps its natural flavour and its rancidity is considerably delayed.

As to the cost, the author estimates that for a dairy treating 15 000 litres of milk per day, the use of an apparatus for sterilising the water with ozone only requires half a kilowatt of electricity per day. P. D.

641. **Influence of Pasteurisation on the Digestibility of the Albuminoid and Mineral Constituents of Milk.**

TERROIN, E. F. and SPINDLER, H. — Influence des divers procédés de pasteurisation par chauffage sur la digestibilité des constituants albuminoïdes et minéraux du lait. *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 180, No. 11, pp. 868-870. Paris, 1925.

The authors administered to the same animal, a young pig of 8-10 kg., in successive periods of 7 days, cow's milk fresh or subjected at one time to pasteurisation at a low temperature (heating to 63°C for 25 minutes, stirring mechanically, then cooling), and at another time to pasteurisa-

tion at a high temperature by the STASSANO process (heating to 95° for one or two minutes continuously, then cooling).

The exact daily determination of the volume of milk taken and the weight of faeces, and the total nitrogen and ash content of the milk and faeces, enable the coefficient of digestibility to be determined.

The values found by this test lead one to conclude that none of the processes of pasteurisation by heating, which were examined, in any way modifies the digestive utilisation of the protein matter and ash.

A comparison of the results of the test with those previously obtained on other species, clearly shows the complete absence of any specific intervention of the origin of the milk in the utilisation of the protein substances of milk, and an inferiority in the absorption of the ash of cow's milk, slight in the case of the young pig, rather high in that of man.

P. D.

PLANT DISEASES.

Plant parasites.

642. Dust Treatment for Control of Oat Smut (*Ustilago Avenae* and *U. Levis*).

THOMAS ROY, C. *Science*, n. ser., Vol. LXI, No. 1567, pp. 47-48. Lancaster, Pa., 1925.

In the investigations on the control of oat smut (*Ustilago Avenae* and *U. levis*), dust treatment tests in the past have given variable results. While mixtures containing copper and nickel, in the form of dust, have almost always greatly reduced smut, their anticryptogamic efficacy has not always proved such as to warrant the general use of dust treatments.

The result of three years' tests in Ohio is that neither compounds of copper nor those of nickel, used alone or as dust, are sufficient to control oat smut. On the other hand in combination with corrosive sublimate, the mixture proved to possess an anticryptogamic value which compares very favourably with formaldehyde.

In treating the seed it is not only desirable that the fungicide used prove effective against smut, but also that seed germination be stimulated or, at least, not weakened. By the use of compounds of copper or nickel (carbonate, sulphate and acetate of copper, and carbonate of nickel) combined with corrosive sublimate, the seed germination was stimulated to a marked degree, which is not the case with the formaldehyde treatment.

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In the preliminary tests, one part of the salts of copper or nickel and two (by weight) of corrosive sublimate were well mixed and powdered. Three ounces of the mixture per bushel of seed were used. Corrosive sublimate used alone proved to possess but very slight adhesive properties; moreover, owing to its relatively high cost and extreme toxicity it would be less readily used alone than with some other compound which might serve as a vehicle. The fundamental idea is to add to the salts of copper or nickel, just enough corrosive sublimate to raise the anticryptogamic power of the mixture to the required degree for the control of oat smut. Further experiments are necessary in order to ascertain more accurately the minimum quantity of the salts which may be effectively used, bearing in mind also the reduction in cost. G. T.

643. ***Bacillus Phytophthorus*, the Cause of " Potato Blackleg " disseminated by the *Phorbia fuscipennis* Dipteron in Minnesota.**

LEACH J. G. The Seed Corn Maggot and Potato Blackleg. *Science*, n. ser., Vol. LXI, N_o 1570, p. 120. Lancaster, Pa. 1925.

It has hitherto been generally considered that the tubers from infected seed are the sole cause of infection by, and the dissemination of, the so-called potato blackleg, a disease caused by *Bacillus phytophthorus* Appel. Also that all the tests have shown that the pathogenic agent does not winter in the soil; it has also been thought that it winters only in the partially decomposed tubers.

The author's recent observations have led to the conclusion that the Dipteron, *Phorbia fuscipennis* Zett ("seed-corn maggot"), largely diffused in the United States of America and known to be injurious to a large number of crops, is a common agent of the dissemination and inoculation of blackleg in Minnesota. Preliminary tests also show that the pathogenic agent may be biologically transmitted by the insect, which affords another important means of wintering.

The eggs of the Dipteron are deposited on tubers before they are planted. It has been shown that the eggs may be contaminated by the bacteria when they are deposited. The larvae of the insect have been found in a very large percentage of fragments of tubers under diseased plants, whereas they have never been observed in sets of tubers from which plants not attacked by blackleg have sprung. The larvae abandon the decomposed fragments and, entering the soil, change into chrysalises before or a little after the symptons of the disease begin to appear on the shoots of the host plant. This probably explains why they have not been observed more frequently.

The larvae of the Dipteron act as agents of inoculation by boring galleries in the fragments of tuber, introducing the bacteria therein and at the same time favouring the development of the disease by inhibiting the normal tendency of the segment of tuber to develop a cork-like stratum which prevents decomposition. In tests made over a period of more than three years, more than 500 segments of tuber, partially decomposed by *Bac. phytophthorus*, were planted in both moist and dry soils. All

the segments, with the exception of a few which decomposed completely before the germs could develop, remained immune from the decomposition caused by the bacteria, and gave rise to healthy plants. The tubers were treated in such a way that the Dipteron could not come into contact with them before planting; no larvae were found in the segments. On the other hand, when nine segments immune from the bacteria, and each bearing one or more eggs of the Dipteron were planted, two cases of blackleg developed. In the segments of tuber from which the two diseased plants sprang were found larvae of the Dipteron, but this was not so in the other seven. The greater part of the eggs used in the test were of unknown age and therefore of doubtful vitality. If all the eggs had been deposited a short time before, most probably a larger number of plants attacked by blackleg would have been obtained.

In numerous cases examined by the author, in which a high percentage of blackleg was observed, in spite of the disinfection of the seed tubers, almost invariably the tubers themselves were disinfected some days before planting and were then left in the open air. The treatments usually adopted kill all the eggs present on the tubers. If larvae were found in the segments of tuber whence diseased plants sprang, the eggs of the Dipteron must have been deposited after the treatment and were doubtless the source of infection. Where the seed tubers were disinfected and planted immediately, very few cases of blackleg were observed. From this it is deduced that if the object of the disinfection of the seed tubers is to control the disease, the tubers treated should be planted immediately after treatment or else kept in a place inacessible to the Dipteron.

G. T.

644 ***Bacterium Salicis*** **n. sp. Injurious to** ***Salix caerulae*** **in England.**

DAY W. R. The Watermark Disease of the Cricket-Bat Willow (*Salix cærulea*). *Oxford Forestry Memoirs*, No. 3, pp. 30, figs. 17. Oxford, 1924.

A description of a serious epidemic observed in recent years on *Salix caerulea* (Cricket-bat Willow) in the Counties of Essex and Hertfordshire (England) and caused, as has been shown by inoculation tests, by a bacterium which the author describes and proposes to call for the time being *Bacterium Salicis* n. sop.

The largest trees are generally attacked, the wood of which, even in the first year of attack, greatly depreciates in value; after two or more years the tree dies.

Symptoms of the disease: general withering of the leaves (in May, or occasionally at the end of July) on one part only of the crown; the leaves then turn brown, hang down from the branches for a certain time and finally die; gradual death of the branches; frequent formation of adventitious shoots; bacterial exudation on the dying branches, which arises from masses of bacteria occupying the vascular tissues, and which issues through wounds in the bark caused for the most part by [illegible].

If an affected branch be cut through, there will be noticed in the area of wood occupied by the bacteria a dark-coloured spot, quite char-

acteristic and commonly known in Essex under the name of "Water-mark", whence the name given to this disease, of "watermark disease of the cricket-bat willow".

On the dying branches attacked by the latter, the *Cytospora chrysosperma* (Per.) Fr. fungus develops during the summer; observations in the open field and experimental tests made in connection therewith, revealed the fact that the fungus is a saprophyte, capable of developing normally on dead tissues, also a possible parasite which can attack and kill living tissues, provided they are already weakened or predisposed to the disease; but *Cyt. chrysosperma* alone is incapable of causing the death of a healthy and vigorous tree.

The infection caused by *Bact. Salicis* always starts in the crown of the tree. This bacterium is a strictly vascular parasite which penetrates into its host through wounds already existing on the smallest branches, generally caused by insects which themselves may serve as a vehicle for the disease. After the disease has commenced to spread, the bacterial exudation undoubtedly constitutes a source of infection by which the bacteria are diffused from tree to tree.

The presence of the micro-organism is limited to the larger vessels of the wood; it was not found in the leaves or in the smaller roots.

The death of the organs of the tree which are attacked, is chiefly due to the stoppage of the water supply which takes place in the tree, through the closing up of the vessels by masses of bacteria. Another and generally secondary cause of death is the poisoning of the sap by the by-products of the bacteria and by substances produced by the dead parenchymatic cells in the wood.

From observations made in the open field it seems that trees which grow in a locality with a permanently moist subsoil are more subject to the disease than trees situated in places with a moist but well drained, or even very dry subsoil. The diffusion of the disease is also favoured when the trees are planted too close to one another. The best means for the control of the disease is based on the selection of a suitable locality and strict observance of the general rules of hygiene. G. T.

645 ***Macrophoma Corchori*, a Deuteromycete Injurious to Jute (*Corchorus capsularis*) and other Plants in India.**

SHAW F. J. F. Studies in Diseases of the Jute Plant. *Macrophoma Corchori* Saw. *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. XIII, No. 6, pp. 193-199, 2 plates. Calcutta, 1924.

In Eastern Bengal and E. Behar the jute plant (*Corchorus capsularis*) is sometimes attacked by a stem rot. The disease generally attacks the stem near the ground or somewhat higher, and in the first stages causes a pale reddish brown colouring, gradually changing to brown, which spreads along the stem and all round it until the whole plant dies. Sporadic cases of this stem rot may be found in almost every jute field, but only in certain conditions of cultivation does the disease become epidemic. It may attack the jute plant at any stage of its growth, and

thus shows itself both on *C. capsularis* and *C. olitorius*. Very young seedlings die with symptoms of 'damping off', the hypocotyl becoming soft and completely rotted. In such specimens an abundant mycelium develops in the tissues of the young fruit. In more mature plants the mycelian growth is accompanied by a copious formation of small black sclerotia in the interior of the stem among the fibres and by the development of pycnidia visible as black points just below the cuticle.

An examination of the diseased stem reveals the fact that the fungus consists of brownish hyphae and deep black sclerotia. Both the hyphae and the sclerotia are intermingled with the fibre. On the surface of the stem are to be seen numerous small black pycnidia.

The inoculation tests show that the pycnidia and sclerotia forms belong to the same fungus, which the author has identified as *Macrophoma Corchori* SAW, described as a new parasite of the jute plant in Japan in 1916. The pycnidial form is seen only on the jute plant and has never been obtained in artificial culture. The sclerotic form on the other hand develops in artificial culture and also on jute and cotton plants, potato tubers, etc. Cultures isolated from the jute, cotton, and potato, give rise to the pycnidia form when inoculated on the jute plant.

It was observed that the quantity of potash present in the soil is a determining factor of the disease: tests now being made at Pusa show that *M. Corchori* can develop a vigorous mycelium if cultivated in a substratum not containing potassium. Field tests made at Dacca also point to the fact that jute is a plant which reaches its greatest development when the quantity of potash available in the soil exceeds that normally required by other plants.

G. T.

645. ***Phytophthora omnivora* var. *Arecae*, Peronospora Injurious to the Coconut Palm in Malabar.**

SUNDARARAMAN S. and RAMAKRISHNAN T. S. *Memoir of the Department of Agriculture in India, Botanical Series*, Vol XIII, No. 4, pp. 77-97. Calcutta, 1924.

In many districts of Malabar, Canara and Maipur, the betelnut (*Areca Catechu*), has been subject for some years to a disease commonly called "Mahali" or "Koleroga", which causes the rotting and fall of the fruits and in severe cases the crown of the palm itself. A disease in many respects resembling this was reported as injurious to the coconut palm for the first time in August 1922, in some parts of Malabar after the violent south-westerly monsoon. Owing to the fact that the symptoms of the disease are similar in both cases, the growers in Malabar also give the coconut-palm disease the name of "Mahali".

It causes large numbers of the nuts to fall, both young and mature, and the latter, if attacked, are dark or blackish brown, either at the base only or over almost the whole of the lower half. In nuts which have recently fallen, the brown spots have a fine whitish covering which under the microscope is seen to be formed of the mycelium zoosporangia

of a Peronosporaca (*Phytophthora*). If one of these fallen nuts be split open, the pericarp is found to be soft and rotted in those parts which correspond to the external spots, the kernel also is soft and partially or wholly rotted, has a disagreeable odour and is unfit for consumption. Under the microscope it is seen to be completely invaded by the mycelium of the fungus. The milk contained in the nut becomes brownish and emits a foetid odour. Sometimes both the principal and secondary axes of inflorescence are attacked.

The Peronospora has been cultivated and culture inoculation tests have been made at Coimbatore on the fruits and buds of the coconut and areca; such tests have shown that the fungus may be considered to be the agent of the disease. The inoculations also showed that this fungus is identical with *Phyt. omnivora* var. *Arecae*, which causes the disease in the betel nut known under the name of "Mahali" or "Kole roga".

The disease appears on the coconut only when the palms grow up with *A. Catechu*, which, after being attacked by "Koleroga", in their turn infect the coconut palms.

The means adopted for control of the disease on *A. Catechu* may also be used for the coconut: all the diseased and spoiled nuts lying on the ground are collected and burned, together with the other affected parts removed from the tree, after which the inflorescences are sprayed with Bordeaux solution. The treatment should be applied immediately before the rains set in and again during an interval of fine weather.

G. T.

647 **Diseases of the Coffee Plant in the State of São Paulo (Brazil).**

AVERNA-SACCÀ, R. Segunda contribuição para o estudio das molestias cryptogamicas do cafeeiro. *Secretaria da Agricultura, Commercio e Obras Publicas do Estado de São Paulo, Serviço de Publicações*, 63 pp., 11 figs. São Paulo, 1925.

The first contribution to the investigation of the fungous diseases which attack coffee in the State of São Paulo (Brasil) was published by the author in 1917. The present one, which has now been printed, completes the preceding one, recording some fungi new to science and giving further information on some old diseases, which deserve the greatest attention on the part of planters.

It should not be thought that the numerous fungi described and illustrated in these two works include all those which live on the coffee-plant in the State: besides the mycetes he has been able to gather and examine, many others must exist over the whole of the coast zone.

In the present publication the author examines the following fungi:

(1) *Glomerella coffeicola* Averna n. sp. (conidial form: *Colletotrichum incarnatum* Zimm.; f. spermogonia: *Cytosporina coffeicola* Averna

n. sp. ; f. pycnidia : *Diplodia coffeicola* Zimm. ; f. ascophore : *Gl. coffeicola*, which cause the disease, locally known as "queima do cafeeiro".

(2) *Pestalozzia coffeicola* Averna ;

(3) *Clasterosporium coffeanum* Averna ;

(4) *Hendersonia coffeicola* Delacroix ;

(5) *Stictis coffeicola* Averna ;

(6) *Lachnea hemisphaerica* (Wigg) Gill ;

(7) A sterile mycelium, which causes a form of root rot ;

(8) *Chaetophoma coffeicola* Averna ;

(9) *Nectria coffeigena* Averna (conidial form : *Fusarium coffeicola* P. Henn., f. ascophore : *N. coffeigena*) ; Common names : "café chocho", "cancro do café" ;

(10) *Sphaerostilbe flavida* Massee (sin. *Stilbum flavidum* Cooke ; *Pistillaria flavida* Speg. ; *Stilbella flavida* Kolh ; *Omphalia flavida* Maubl. et Rang.) ; Common Brazilian name : "requeimado".

Having described the injuries caused by the above fungi, the author gives their morphological characters and the best means for their control.

G. T.

Animal Parasites.

648. **Orthoptera in Bengasi.**

ZANON, V. Contributo alla conoscenza della fauna entomologica di Bengasi. Ortotteri di Bengasi. Extract from the *Memorie della Pontificia Accademia delle Scienze Nuovi Lincei*, Vol. VII, pp. 23. Rome, 1924.

Enumeration of 47 species of Orthoptera collected by the author in the Bengasi districts from 1915-1919. While all are important from a scientific point of view, according to the author, systematic and biological knowledge is lacking as regards the representatives of this order of insects in Libya and some are also important from the economical point of view, because recognised as injurious to various crops.

The list is preceeded by a detailed account of a notable invasion of locusts, the flight originating from the South, the predominating variety being the «speckled locust» (*Tettigonia albifrons* Fabr. *Decticus albifrons* Serv. ; in Arabic, "bugerada" or "bugiarada"), from which the Bengasi zone suffered in 1918-19.

The garden crops and seeds were destroyed ; ripening barley and wheat were also involved and the wells defiled. Vines suffered only slightly ; some bunches of grapes were nipped off, but the leaves remained intact.

The presence of various natural enemies was observed (*Sphex flavipennis* hymenoptera, and the following birds : *Tinnunculus vespertinus*, *T. neumanni*, *Emberiza citrinella* and sparrows), but for various reasons their intervention in the campaign against *T. albifrons* was insufficient.

G. T

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649. **British Coccidae.**

GREEN, E. Observations on British Coccidae, IX. *The Entomologist's Monthly Magazine*, Vol. LXI (3rd Series, Vol. IX), No. [illegible] (No. [illegible]) pp. [illegible]-44, 5 figs. London, 1925.

Kuwania pini, which the author describes as a species new to science, was collected on *Pinus sylvestris*, at Oxshott (Surrey). This is the first time that the presence of a Coccida on pines has been reported in the British Isles.

On branches of *Hoheria populnea*, in the Scilly Isles, *Eriococcus hoheriae* Maskell was observed. This is the first time the insect has been found outside its native country (New Zealand).

The following are also described as species new to science: (1) *Pseudococcus* (*Trionymus*) *phalaridis* living on *Phalaris arundinacea*, at Frimley (Surrey) — it has a very effective natural enemy (which preys on the *Ochthiphila polystigma* larva); (2) *Ps.* (*Tr.*) *peregrinus*, on the roots of the *Nerine flexuosa* Amarillidaceae, at Exbury, near Southampton; (3) *Lepidosaphes laterochitinosa*, on *Coelogyne* sp. at Wisley (Surrey).

In the already long list of the host plants of *Lecanium persicae* (Fab.), *Tamarix*, on which the Coccida was collected at Andover (Hants), should be included. Such a discovery is of special interest as it is the first time a Coccida has been reported to be found on such a tree in Great Britain.

A specimen of *Laurus nobilis* was found very seriously infested by *Aspidiotus britannicus* Newst (the locality where the observation was made is not indicated).

Lepidosaphes ulmi (L) was found on *Helianthemum vulgaris* (on the Hog's Back, near Guildford) and on *Erica Tetralix* in the neighbourhood of Camberley. G. T.

CURRENT NOTICES

Legislative and Administrative Measures.

650. **The Fruit Wines of Costa Rica.** — The production of these wines has been regulated by the decree of December 1924. (*La Gaceta*, 24th of December 1924).

651. **Control and Protection of Forests in Spain.** — The Royal decree of March 12th. 1924, gives general directions respecting the protection of forests against diseases and pests.

The "Ministerio de Fomento" may contribute to the expenses entailed in this respect by town councils and private persons. Further provision may be made for the formation of syndicates composed of proprietors of the attacked zones, who by cooperation will be better able to control pests. The Royal Order of February 21st., 1925 has regulated State support in this matter. (*Gaceta de Madrid*, 26 February 1925),

652. **Spain. The Felling of Trees on Private Property.** — Further instructions were issued in this respect on the 4th of March, 1925, in addition to the *Royal decree* published on December 3, 1924.

653. **Spain. Regulations concerning Wines and Alcohol.** — Published in a *Royal decree* of September, 1st 1924; the question is treated principally from the fiscal point of view. Attentionis drawn to article 7. which states that in order to prevent over-production of wines, which would naturally cause difficulties in the wine-markets, new plantation of vineyards is prohibited with the exception of special cases.

654. **France. Repression of Fraud in the Fertiliser Industry.** — The decree of March 19th 1925, supplements the former law of February 1888. Regarding the repression of fraud in the fertiliser industry, it is prescribed that all commercial documents together with the labels on the packages must state full details as to the chemical substances contained in the fertilizer in order to protect the purchaser from fraud. (*Journal Officiel*, 22 March 1925).

655. **France. Regulation of the Trade in Cereal Seeds.** — With the presidential decree of 26 March 1925 the selling of wheat seed packed in any other than the prescribed way is forbidden. The labels on the packages must bear information as to the variety of wheat, its origin and the average percentage of this wheat in the package. Only such wheat may be sold as first class or choice seed, and that which is obtained by individua

selection must contain not more than 1 % of seeds of other varieties than the one indicated. The germination capacity of the wheat, when not specified, must not be less than 85 %. (*Bulletin de l'Office de renseignements agricoles*, No. 7, 1925).

656. **Colonisation in Algeria.** — Measures have been taken for the reservation of State lands for colonisation in Algeria. (*Bulletin agricole*, December 3rd, 1924).

657. **Morocco. Decree for the Agricultural and Silk-Industries.** — A Vice-Regal decree has been issued dated Dec. 20, 1924, concerning the distribution of prizes for motoculture; for the preparation of land for planting or for the grafting of olive and carob trees, and for planting of mulberry-trees. (*Bulletin Officiel*, 30 December 1924).

658. **Martinique. The Encouragement of various Plantations in Martinique.** — By special decree a bonus for various plantations has been established, as follows: for each coconut palm 5 fr.; for each lemon-tree 2.50 fr.; cacao and bananas 1.50 fr.; coffee and sisal, 0.50 fr.; vanilla 0.30 fr.; cotton 0.10 fr.; tobacco 0.05 fr. Arrangements have been made for the distribution of these bonuses and practical instructions respecting the various plantations have been published. (*Journal Officiel de la Martinique*, July 10, 1924).

659. **Measures for Protection of Plants against Parasitic Diseases in French Oceania.** — By special decree amending the decree issued January, 1916, measures have been taken to forbid the importation of coconut palms, and all other kinds of palms, as well as of coffee plants, banana plants and other Musacea. The regulation applies also to their fruits, leaves or seeds. (*Journal officiel des Etablissements français de l'Océanie*, December, 1924).

660. **Italian Laws and Decrees respecting Land Improvement and the Granting of Agricultural Credits.** — The Royal Decree of February 5th, 1924, exonerates the communes from contributing to the land improvement tax hitherto sustained by them alone. Further provision is made for the collaboration of the State and the Provinces as regards the rate of interest charged on loans. The Royal Decree dated February 8th, 1925, appoints an interministerial Committee, with powers to carry out improvement of lands in the public interest. The decree of 19 February, 1925, of the Ministery of National Economy treats of agricultural credits; of the agricultural credit Banks of Caserta and of Lecce. The decree of the same Ministery, dated 31st of January, 1925, deals with the granting of loans for agricultural purposes.

661. **Measures for the Control of Plant Diseases in Italian Somaliland.** — By two Governmental decrees of November 1924, the importation of seeds, plants and parts of plants without special permission of Government authorities is prohibited. The importation of American cotton seed is prohibited and an eventual disinfection or even destruction of the existing imported plants is ordered as well as the immediate destruction of the cotton plants after picking is over. In some cases the total or partial destruction of the entire crop is ordered even before picking. Seed not used in oil factories, or for sowing is also to be destroyed.

662. **Holland. Ministerial Regulations for the Control and Marking of Cheese.** — The Dutch Minister of the Interior and Agriculture, Department of Agriculture, Section V, has published instructions amending previous

laws (23 March, 1925) in respect to the examination of samples of fat cheeses (1st quality) as well as those of skim-milk cheeses, and the analysis of samples. Analysis is made in respect to the percentage of fat, which is determined by quantitative and empirical methods. (*Nederlandsche Staatscourant*, 15 April, 1925, No. 72).

663. **Paraguay: Cotton Seed in Paraguay.** — In virtue of Art. 1 of a decree No. 18218, the cotton planters and exporters of cotton must keep in reserve 30 % of seed obtained every year, in order to supply the requirements of the next crop.

Art. 2. of the same decree forbids the importation of cotton, if not accompanied by a special certificate, to be issued by the Banco Agrícola.

664. **Rumania: New Regulation for Wheat, Flour and Bread.** — Legislative measures are published in No. 4 of the *Monit. off.* (6th January, 1925), by which the exportation of wheat and its derivatives is prohibited. The national mills are obliged to recover from the wheat integral flour to the extent of 85 %.

In time of urgent need, or war, the Government is empowered to seize all wheat and flour required to supply the needs of the population or army. Maximum prices are fixed for wheat standard flour, for the flour already in store, and also for the above-mentioned Government requisitions.

665. **Venezuela: Protection of Forests and Water Reserves of Venezuela.** — A law has been issued dated June 1924, respecting State and private forests, the maintenance of the public and private water supply, the navigation of rivers, concessions for the erection of hydro-electric works, the maintenance of lakes, wells, etc.

Experimental Stations and Agricultural Instruction.

666. **Germany: A German Research Laboratory for Chemical Fertilizers.** — The *Chemiker Zeitung*, March 10th, 1925, announces that the « Kaiser Wilhelm Society » intends to found a research laboratory for fertilizers. This Institution will collect and co-ordinate information on the subject, not only of the different fertilizers, but will study also the complicated questions of plant nutrition and the fertility, and properties of the soil. Furthermore it will study the best methods of application of fertilizers and the action of stimulating chemical substances, accomplishing in this respect a revision of the the studies already completed by others. This Institution will therefore constitute a Research Station in the widest sense of the word, studying problems of soil, plants and fertilizers in all their inter-relations.

667. **Germany: A Hydrological Research Station** has been founded at Obernachtal, by the Bavarian Government, near the laboratories of the « Kaiser Wilhelm Gesellschaft » at Walchensee.

668. **Phenological Maps published by the German Phenological Service.** — Under the direction of State Councillor Prof. E. WERTH, phenological maps have been published in No. 25 of the *Mitteilungen aus der Biologischen Reichsanstalt für Land und Forstwirtschaft*. This number was issued in December, 1924, and forms the annual for 1922, of the *Phänologischen Reichsdienstes*.

669. **Germany: The "Karl-Heinz-Thost Foundation".** — The *Deutsche botanische Gesellschaft* has opened a competition to all German and Austrian-German botanists on the subject: "To promote by personal original research and by critical annotation from recent literature the study of the influence of the duration of daylight on the growth of the plants". For this competition a prize of 500 gold marks has been offered by the « KARL-HEINZ-THOST » Fund. The answers should be addressed to the President of the *Deutsche Botanische Gesellschaft* in Berlin not later than April 30th, 1926. The judging committee consists of Professors C. CORRENS, L. DIELS and H. KNIEP.

670. **Brazil: Programme of the Experimental Station for Cocoa in Brazil.** — The Brazilian Minister of Agriculture has organised a programme of work to be carried out in the current year by the Experimental Stations for cocoa of Ilhéos in the State of Bahia and of Goyatacazes in the State of Espirito Santo. Following is a resumé of this programme: (*a*) to remove the plants from the soil of the fazenda and to space out ground for the new, simple, experimental cultivations; (*b*) to carry out planting experiments with Criollo cocoa, the distance between plants to be 5 metres, part of the plants to be grown under shade and part without shade. Cultivate each year half of the ground for each part; (*c*) carry out similar experiments with other varieties of cocoa, but varying the distance between the plants; (*d*) use as shading trres "molungu" and other trees of the leguminous family, taking care to use small leguminous trees as long as the cocoa plants are still small; (*e*) to plant on small plots of ground, at a distance from those plantes with "Criollo" cocoa, the varieties that are also found at S. Bento das Lages; (*f*) to ascertain the best conditions for each variety of cocoa with respect to adaptation and productiveness, in relation to atmospheric humidity, soil formation, nature and depth of the subsoil, chemical composition of the soil, the movement of water, subterraneous water-table, etc.; (*g*) to study the influence and the advantages of pruning and grafting and above all the increased production of the better varieties or of the most productive trees; (*h*) to ascertain the yield per hectare and per plant of each variety of cocoa, shaded and not shaded, and varying distances between the plants, with cultivated or uncultivated ground, with or without the use of fertilizers; (*i*) to keep cattle in the Station in order to demonstrate the utility of manure, and to use also the cocoa residues for the fertilization of the plantation, leaving parts without fertilizers for comparison; (*j*) to plant on the plots already used for cocoa, intermediate rows of "seringueiras" (seeds and cuttings of S. Bento das Lages) and to suggest such measures to "fazendeiros" whose grounds no longer produce cocoa in satisfactory quantity; (*k*) to plant certain lots with "Robusta" and "Stenophylla" coffee, also derived from S. Bento dos Lages; (*l*) to plant on the Station grounds tea, quinine, camphor, oriental pepper, chalmoogra, etc. with seeds from S. Bento dos Lages or from the "Istituto Biologico de Difesa Agricola"; (*m*) to maintain nurseries for the growing of the best qualities of cocoa and other useful plants of the region, including forest-trees such as eucalyptus, teak, etc., using plants from the Botanical Gardens; (*n*) to inspect the plantations of the zone, determine the diseases and their causes, to study the means of remedy and the methods of treatment and to ascertain the maximum or minimum resistance of

each cocoa variety against these diseases, and to ascertain their causes : (o) to
study the fermentation and drying of cocoa by means of practical experiments,
until definite results are obtained ; (*p*) to show the advantages and disadvan-
tages of the washing of cocoa ; (*q*) to grade the various kinds of cocoa so as
to obtain better quotations on the markets ; (*r*) to study the immunity of
cocoa to mould ; (*s*) to study the uses of the hull and the pulp of cocoa. (*Gazeta
da Bolsa*, Year VIII, No 6, Rio de Janeiro, 1925).

671. **Spain : The Agricultural Fields (" Campos agrícolas ") attached to the National School in Spain.** — The sum of 1000 pesetas has been placed at the disposal of the Director of each of these fields, available for the scholastical year 1924-1925. (Royal order, 17 February 1925, published by the President of the Direttorio Militare).

672. **United States : Experiments on Growing of Sugar-beet in Louisiana, U. S. A.** — The results of these experiments may be summarised as follows : (1) on hilly ground near the Bâton-Rouge and on land in the East of Louisana once covered with pine forests, sugar beet was successfully planted. The beets had a sugar content of 13-14 %, and purity 80-85 %. Alluvial soil will probably prove favourable for this crop. (2) The yield may reach 10 to 15 tons per acre. The average yield per acre for the United States is about 9.5 tons. (3) The cost of production is relatively low. (4) The duration of the harvest varied in the last years from 6 to 12 weeks, beginning early in May. (5) The experiments show that the sowing should take place earlier, e. g., in September-October. (6) The beets at harvest time weigh from 1-2 lb. Uniformity in size indicates good quality but is not indispensable. (7) In the experiments at Bâton-Rouge no fertilizers whatsoever were used. (*Chemical News*, Vol. 130, No 3389, pp. 9-25).

673. **Nebraska (U. S. A.). Experiments in Cereal Growing.** — Messrs. L. L. YORK and W. W. DURR of the Nebraska Experiment Station have published in a special " Bulletin " the results of researches made during 16 years in corn-growing at the North Platte Dry-Farming Sub-Station. (*The Agricultural Review*, April 1925).

674. **New courses of Rural Science at the " Virginia Polytechnic
Institute ".** — To the instruction in this polytechnic school which extends
over 4 years and includes the study of various branches of science concerned
with Agriculture, have been added the following courses : Agricultural Geo-
graphy, History of Agriculture in America, History of English Industry, Stat-
istical Methods of Agricultural Accounting, National Economy, Rural Econo-
my and Rural Sociology. Courses on marketing of agricultural products, on
rural co-operation and on the cost of production of agricultural products, had
already been held. (*Journal of Farm Economics*, Vol. VI, No 3).

675. **International Seed Exchange.** — Nearly a hundred botanic
gardens issue annually or biennially a seed list for the purpose of mutual ex-
change ; these gardens are chiefly in Europe. Those in Asia are : Tokyo, Sapporo,
Buitenzorg, Tiflis ; in Africa : Kirstenbosch near Cape Town, Tunis ; in South
America : Montevideo ; in North America : Ottawa and Brooklyn. The
Curator of Plants, Dr. GUNDERSEN of Brooklyn Botanic Garden, U. S. A.,
invites correspondence on this matter. (*Science*, Vol. IX, No. 1543. Lancaster,
Pa., 1924).

676. **United States: Annual Report of the American Research Laboratory for Fixed Nitrogen.** — The director of this Laboratory, F. G. COTTRELL, gives an account of work carried out during the 5th year. The most important investigations refer to: (1) the synthetic ammonia process, the cost of which may be reduced by 50 %, by a better use of catalytic agents; (2) the fixation of nitrogen as cyanides; (3) the fixation of nitrogen as nitrate of aluminium in order to obtain aluminum and ammonia; (4) researches on cyanamide, and also on nitrogen-fixing microorganisms, and on the recovery of oxides of nitrogen from the gaseous mixtures obtained by the oxidation of ammonia.

Special attention was given to the fixation and utilization of atmospheric nitrogen and to the fundamental principles of the process. From this standpoint it is important to know the conditions under which the molecule of nitrogen can unite with other elements.

The production of active oxygen and of ozone is connected with the same problem as well as the reversibility of these processes. The work on the explosive decomposition of ozone shows the possibility of using the electric arc process for nitrogen fixation and also for the formation of nitric oxide.

Seventeen scientific publications have been issued during the past year, as well as publications of an informative or commercial character. (*Annual Report of the Director of the Fixed Nitrogen Research Laboratory*, pp. 1-5, Washington, D. C., 1924).

677. **American Foundation for the Study of the Chemistry of Wood and its Derivatives.** — The "Northwest Paper Company" and the "Cloquet Lumber Company" of Cloquet (Minn.) have given a fund of $5000 to the Agricultural Biology Section of the University of Minnesota to encourage the study of the chemistry of wood and its derivatives as well as the utilisation of wood products.

678. **Cuba: Note on "Mosaic" of Sugarcane.** — In order to promote these studies a new credit of 6000 pesos has been given, in November 1924, in addition to former endowments. (*Gaceta Oficial*, 28 November, 1924).

679. **France: A Technical School for the Study of Petroleum** has been founded at Strassburg by the French Government for the instruction of specialists and the development of scientific or technical studies on combustible liquids. The School is divided in 3 sections: Geology, development, chemistry of petroleum. (*La Journée industrielle*, 28 December, 1924).

680. **Morocco: A Native School of Agriculture** was opened at Fez on January 1st, 1924. Two kinds of instruction are provided: general and technical. The general instruction includes: the French languages, mathematics, surveying, levelling, economic geography, hygiene. The technical courses consist of: botany, agriculture, horticulture and fruit-growing, principles of agriculture from a physical and chemical point of view, agricultural mechanics, anatomy and physiology of animals, hygiene and stock-breeding. Half a day each week is given to practical demonstrations on the experimental farm ([illegible] hectares), situated near the gates of Fez (Bab Segma). At certain times pupils stay for several days on the farm, under the direction of the instructor or of one of the Professors, and take part in ploughing, sowing, weeding, grafting, reaping, grape-gathering, pruning, fruit-picking, etc. The greater part of

the stock-breeding courses are given at the veterinary Station in the town. *Renseignements coloniaux et documents publiés par le Comité de l'Afrique française et le Comité du Maroc*. Suppl. nº 3 de l'*Afrique française*, 1925).

681. **Professional School of Agriculture in Porto-Novo (Dahomey).** — In accordance with a decree of 16 October 1924, the Lieutenant-Governor of the Colony has re-organised this School. (*Journal Officiel de la Colonie du Dahomey*. November 1st, 1924).

682. **Great-Britain : Agricultural Research in France and Great-Britain.** — Mr. W. R. BLACK, of the Ministry of Agriculture and Fisheries has written a short comparative study on French and British Agricultural Research. He states that this service has been introduced more recently in France than in Great Britain. In France it dates from the year 1921 and in Great Britain it was installed in 1909. Research in the following subjects is carried out by both countries : Soils, plant pathology, plant breeding, cattle feeding, stock-breeding, animal pathology, farm engineering. In Great Britain the following branches are especially studied : plant physiology, horticulture, glasshouse crops, agricultural economics. In France the special branches are physics and meteorology from an agricultural point of view and agricultural bacteriology. The author points out the similarities and differences between the systems of the two nations and mentions that in France there is a stronger tendency towards centralization

The British organization is gradually becoming more centralized without diminishing the liberty of the workers. In respect to personal remuneration and the valuation of scientific material, it is stated that French officials have less advantages than the British. (W. R. BLACK, "Agricultural Research in France, a comparison with Great Britain"; *The Journal of the Ministry of Agriculture*, p. 36-46, 1925).

683. **Great Britain : Experiments on Broccoli Growing** have been carried ont at Gulval, Cornwall, a county which markets about 15 000 tons annually. The varieties are discussed, and the results of selection and hybridisation, also, methods of cultivation, manuring, and the importance of grading and packing. (H. W. ABBISS. *Jnl. of Ministry of Agriculture*, Vol XXXI, No. 12, 1925).

684. **Australia : A National Museum for the Study of Australian Fauna** has been established at Canberra and promises to become an international centre for the study of Australian fauna. As is known, after the introduction of civilisation and of European fauna many Australian types of mammals have disappeared.

Dr. COLIN MACKENZIE had founded the "Australian Institute of Anatomical Research" in Melbourne for zoological and comparative anatomical studies. This Institute includes also a Museum and a Laboratory. In 1924 Dr. MACKENZIE gave to the Government his laboratory instruments and equipment and collection of zoological specimens both living and dead. This collection will form the nucleus of the National Museum, which will be under the direction of Dr. MACKENZIE. (*Science* V. LXI, No. 1580, 1925).

685. **Trinidad : Instructional and Experimental Sugar Factory of the Imperial College of Tropical Agriculture.** — On February 20, 1925, Sir HORACE BYATT, K. C. M. G., Governor of Trinidad and Tobago, officially

opened the new Sugar Factory of the Imperial College of Tropical Agriculture, the first of its kind in the Empire. The machinery of the factory valued at not less than £ 20 000, has been presented by firms of the British Sugar Machinery Manufacturers' Association. A detailed account of the history of the factory, the College Course in Sugar Technology, and a description of the machinery is given in the *Supplement to Tropical Agriculture*, Vol. II, No. 4, 1925.

686. **A New Zealand Demonstration Farm.** — The Stratford Demonstration Farm has an area of 143 acres and carries out demonstration work in connection with pastures, root-crops, green crops and lucerne. The dairy herd has been improved by a good bull and good feeding; the average butter-fat production per cow has risen from 221.1 lb. in 1919-1920, to 305.0 lb. in 1923-1924, the improvement being largely attributed to better feeding. The results obtained are published in the local papers and are carefully followed by farmers, who visit the Demonstration Farm and view the work. Development proceeds at a moderate pace, as extension is dependent upon the income earned. (*New Zealand Journal of Agriculture*, Vol. XXIX, No. 6. Wellington, 1924).

687. **An Australian Agricultural Research Institute** has been established by the University of Adelaide, owing to the gift of £ 100 000 by M. PETER WAITE, a well-known sheep farmer of South Australia. The Government has granted a subsidy of £ 5000 per annum in addition. The Institute will be known as the Waite Agricultural Institute and is situated at Glen Osmond, about three miles from Adelaide; the farm has an extent of 300 acres. Research will be carried out on general agriculture, chemistry, plant diseases and plant breeding. (*Jnl. of Ministry of Agriculture*, London, XXXII, No. 1, 1925).

688. **Italy: Production of Pure Seed in Italy.** — A Summary on the cultivation of cereals of the "Amministrazione Marcello in Fontanella di Odezzo" in the Marca Trivigiana has been published, with a preface by Dr. G. M. MARANI, the technical Director of the "Cooperativa Trivigiana per la produzione delle buone sementi". This publication compiled by Count A. MARCELLO one of the proprietors of a farm in Fontanella, gives information on experiments carried out with varieties of wheat, maize and sorghum. The administration has experimented in the improvement of maize cultivation by genetic selection, mass-selection, and the introduction of new varieties. On Count MARCELLO'S farm it has been shown that the best results are obtained by mass-selection, as proved by the abundance of the harvests, general uniformity and earliness of maturity.

In regard to sorghum, Japanese varietes, Minnesota, Amambler and Honey varieties have been grown.

689. **Italy. Italian Scholaships for Farm Engineers.** — The "Opera Nazionale per i Combattenti in Italia" (for ex-soldiers) in order to obtain the best technical farm engineers (agricultural hydraulic, soil improvement, rural electrification) has granted two scholarships of 6000 lire each. These scholarships are to be given in 2 annual endowments in the scholastic years of 1924-1925 and 1925-1926 to enable ex-soldiers, who have graduated as civil engineres to attend the "Ecole supérieure du Génie rural" in Paris.

Attached to the school is an agricultural Station for hydraulic reseach which offers a course extending over two years.

The first year includes lectures, practical work and the studies of various types of farm engineering, also, excursions and visits to different industrial plants with periods of training.

During the second year of study, in order that the enrolled engineers may become more proficient in agricultural electrical work, opportunity is given to attend the "Ecole supérieure d'électricité" in Paris, where students may obtain the diploma of electrical engineer.

690. **Italian Competition in Agriculture.** — In [illegible] the "Cassa di Risparmio" in Bologna established a prize to be given every four years. This prize is in memory of CESARE ZUCCHINI who for more than 27 years directed without remuneration this Institution. The first competition was opened in 1910 and closed in 1914 and was won by Prof. FRANCESCO TODARO, professor of Agriculture in the "R. Istituto Superiore d'Agricoltura" at Bologna, through his studies in the breeding of cereals.

During the war and in the following years the prizes were abolished, but on the first of April of the present year the competition has been re-opened. The competition consist of two main sections: (1) the best work, discovery, invention, the scientific or industrial application relative to new means and methods for the control of agricultural plant diseases (second competition); (2) and against the diseases of domestic animals employed in agriculture (third competition). For each of these competitions a prize of [illegible] lires, a gold medal and diploma has been authorised. All manuscripts, samples, etc. should be addressed to "Fondazione del Premio Quadriennale CESARE ZUCCHINI presso la Cassa di Risparmio di Bologna". The competition ends on March 31st, 1929.

691. **Italy: Foundation for Study of Feeding of Dairy Cows.** — The R. Istituto Lombardo di Scienze, Lettere ed Arti has received an endowment from the Cav. LUIGI ALLACCHIO of a million lires with instructions to use the interest in prizes for the study and technical improvement of the nutrition of dairy cows and the disposal of the by-products of milk. The regulations will be drawn up by the Institute with the sanction of Prof. CONSTANTINO GORINI.

692. **Italy: Prize Competition: Organic Chemistry as applied to Agriculture.** — The R. Istituto Superiore Agrario of Milan has opened a competition (Fondazione Körner) for the best work in agricultural organic chemistry. The prize is 3000 lire. All replies must be sent to the above mentioned Institute, Via Marsala, 8, Milan, not later than Dec. 31st, [illegible].

693. **Italian Scholarships for the Improvement of Studies relating to Fish.** — By a Ministerial Decree dated [illegible] February, 1925 three scholarships have been opened for the study of fresh water, lake and sea fish. Each scholarship has a value of [illegible] and is open to graduates in natural science or chemistry.

Associations and Agricultural and Scientific Institutions.

694. **The International Federation of Aviculture.** — In accordance to the decision of the Congress held at Barcelona in May 1924 to reconstitute

the International Federation of Aviculture, formed at Brussels in 1905, the delegates of the different nations, invited by the "Fédération des Sociétés d'Aviculture de Belgique" met in the Belgian Ministry of Agriculture in January last and reformed the statutes of the International Federation. Included in work carried out by the new Federation are the following: the revision of standards defining a pure race and the principles to be followed in their application in International Exhibitions; sanitary and Customs regulations; regulation of the trade in eggs and poultry; Poultry Congresses. For these last it is stipulated in the Statutes that the Federation should act in conjunction with the International Associations of Poultry Instructors and Investigators, which has organised the World Congresses held at the Hague and Barcelona and will assist in the organisation of exhibitions. (*La Revue Avicole*, Year 35, No. 3, 1925).

695. **Austria: The Viennese Agriculture and Forestry Club.** — On March 16 of the present year the "Klub der Land- und Forstwirte" celebrated its 50th anniversary.

In 1875, when founded, there was a membership of 152 which rapidly increased to 500. After the war the membership fell to about 250.

The Government agricultural adviser, Dr G. v. HAMM was the founder of the Club. The President is now Dr. M. WILLNER, Director General of the *Land- und Forstwirtschaftlichen Betriebsgesellschaft*.

696. **Columbia. The XXth Anniversary of the Agricultural Association of Columbia.** — Sig. RAFAEL FLOREZ has published a pamphlet on the work of the association (Sociedad de Agricultores de Colombia) during the last 20 years, which was founded in November 1904, under the name of "Sociedad de Productores de Café" which in 1906 was changed to the present title. In 1908 the first number of the "*Revista Nacional de Agricultura*" the periodical of the organisation appeared. The work of the association is described by FLOREZ and biographical sketches are given of the chief members. The present membership is 150 including 21 honorary members. The library of the Association contains a thousand volumes and numerous reviews and journals, national and foreign, which are consulted especially by veterinary and agricultural students. (RAFAEL FLOREZ, *Reseña histórica de las labores ejecutadas por la Sociedad de Agricultores de Colombia en los veinte años de su existencia*; pp. 62, small octavo, illustrated. Bogota, 1924).

697. **Ecuador Agricultural and Stock-Breeding Services.** — The law of October 1924 states that the stock-breeding and agricultural services are under the control of the Ministry of Agriculture.

698. **United States: The Development of the Federal Crop Reporting Service.** — The Federal Crop Reporting Service held its 61st anniversary in May 1924. The Service has developed into an organisation numbering over 300 000 voluntary reporters, 60 Government officials of the Statistical Service, 8 to 10 experts on agricultural production and 120 employees. Each year about 50 000 different reports are published. The work of this Service enables the Bureau of Agricultural Economics of the Department of Agriculture of the United States to publish fortnightly reports on the conditions, the development and the probable yield of cotton. (*Journal of Farm Economics*, Vol. VI, No. 3, 1924).

699. **United States : American Association for the Advancement of Science.** — A large number of scientific and practical institutions and organisations in the United States are now officially united to the American Association for the Advancement of Science. They may be classified as follows : mathematical 2, physical 3, chemical 3, astronomical 1, geological and geographical 8, zoological 6, botanical 6, zoological and botanical 5, anthropological 3, psychological 2, economic and sociological 5, engineering 9, medical 9, agricultural 9, instruction and philosophy 6, various institutions 6. In addition, 12 Academies of science of the different States of the Union are affiliated to the Association, which allows these Academies yearly subsidies for their academical work. (*Science*, N. S., Vol. LXI, No. 1579, 1925).

700. **Cuba. National Association of Horticulture in Cuba** founded by the horticulturists of Havana and Pinar del Rio under the patronage of the Secretary of Agriculture. One of the Association's chief aims is to induce the United States to withdraw the quarantine regulations imposed on Cuban fruit. The Association also endevours to promote rural co-operation, agricultural credits, irrigation, improvement of transport, improvement of rural life and the progress of fruit-growing. (*Bulletin of the Pan-American Union*, September 1924).

701. **France : A National Bureau of Cumbustible Liquids** has been formed in the Ministry of Commerce and Industry with the aim of furnishing to the administration and to French industry, by means of special notices or general publicity, information and documents to improve the distribution of combustible liquids. This Bureau will encourage necessary studies and may organize and support technical instruction concerning the various sections of the petrol industry and its by-products. By means of prizes research will be encouraged for the discovery of new sources of petroleum and of the scientifc application of carburants. The Bureau, if necessary, will carry out these researches itself and by the offering of prizes, encourage improvement of methods of extraction of hydro-carbons contained in the bituminous material in the national territory. The Bureau will decide on all questions appertaining to the distribution in the country of combustible liquids of every nature. It must be consulted on all matters of proposed legislation, on all decrees regarding the regulation of research, of transportation, maintenance, storage or distribution of national hydrocarbons. (*Recherches et Inventions*, Year VI, No. 112, 1925).

702. **France : Reports on the Works of the " Comité Central de Culture Mécanique "** in France, have been collected into a volume of the French review *Chaleur et Industrie*. They treat of the work of the Committee during the year 1924 and refer especially to the national carburants, to the Exhibition of Buc near Versailles and to the different Congresses that have taken place.

703. **The Isle of Réunion Water and Forestry Service** has been reorganised by a decree dated August 28, 1924. (*Journal et Bulletin Officiel de l'île de la Réunion*, Sept. 5, 1924).

704. **Annam Veterinary Sevice.** — A decree of the Governor General regroups the provinces of Annam into 5 veterinary districts

795. **Report of the Department of Agriculture of the Union of South Africa.** — The *Journal of the Department of Agriculture*, Vol. IX, No. 6, consists entirely of the Annual Report for the year ended June 30, 1924. Separate reports are given by the Chiefs of Divisions: Agricultural Economics and Markets, Education, Education for Women, Systems of Schools of Agriculture, Agricultural Policy, Production, Costing, etc.

796. **Italy. Associations for Soil Improvement in Southern Italy and the Insular Possessions.** — At the meeting held in January 1925 of the Committee for the foundation of these associations, it was proposed to further the formation of these associations in Molise, Campagnia, the Puglia, Basilicata, Calabria, Sicily and Sardinia and to promote the formation of Provincial sub-committees. These sub-committees will assist local soil improvements and indicate the individual problems relative to the soil (Communicated, February 1925, by the Committee for the Foundation of Associations for soil improvement in Southern Italy and the insular possessions).

797. **Italy. The "Federation Pro-Montibus" and its Work.** — This Federation which has recently been created a corporate body (Royal decree January 29, 1925) has steadily developed from it foundation in 1909. In 1909 the Federation was composed of only 5 federated bodies, it now has 433, among which are 24 Associations Pro-Montibus, 42 provincial associations, 52 hydro-electric works, 25 local bodies, 256 forestry firms and about forty other organisations. The Federation Pro-Montibus deals with the following: (*a*) forestry and allied indutries and trade; (*b*) bee-keeping and other mountain industries; (*c*) regulation of the water-supply of the forests and its economic utilisation; (*d*) conservation of natural resources; (*e*) protection of professional interests; (*f*) the study and resolution of all questions relating to mountain districts. During the past 15 years of its activity the Federation has organised 4 Italian Forestry Congresses at Bologna, Naples, Turin and Udine, as a result of which have followed legislation regarding forestry and measures relating to water conservation in the mountains, and laws relating to on the State forests, the mountain reservoirs, forestry instruction, irrigation, etc. In addition, 30 local mountain forestry conventions were organized, 50 special forestry shows in which the mountain industries were exhibited, besides displays of medicinal plants and common trees, etc. To this activity has been added that of publication of propaganda and scientific information. The number of these publications amounts to 140 of which 447,000 copies were issued, and periodical publications were also issued. The service of assistance and personal advice amounts to several thousand cases a year. In ten years more than 10 000 celebrations have taken place under the auspices of the Federation, which often distributed saplings, and has given 4000 diplomas and a thousand medals. Further details of the work of this Federation will be published in a special article written in *L'Italia Forestale* of the [illegible] th of March, 1925.

798. **Proceedings of the "Società Agronomica Italiana".** — In a small publication No. 3 (years IV and V) of the Proceedings of this Society have appeared, and are published by the Secretary, Prof. V. RIVERA at irregular periods. The volume contains excellent articles amongst which are: Prof. FERDIANDO CAVARA, The Botanical and agricultural work of ANTONINO BORZÌ; Prof. B. GRASSI, The Anti-malarial work at Fiumicino; Prof. L. PETRI The

methods of investigation and the work of modern phytopathology; G. ALBO, Wheat in the county of Modica; D. BERTONI-CAMPIDORI, The radio-activity in agriculture; G. CATALANO, The organisation of the xerophils, A. CAUDA, Nitrates and nitrites in arable land; A. CAUDA, Rapid formation of humus; G. DE ANGELIS D'OSSAT, Leucite as a potash fertilizer. F. EREDIA, On the wheat climate of Sicily; G. MAYER, The technical equipment of the National Institute of Research on Agricultural Mechanics and its programme for the southern area; G. MUNERATI, The conservation of vitality of seeds in the deeper layers of the soil; L. PETRI, Observations on the morphology and the bacteria of *Pinus Halepensis* and *Pinus Cembra*; V. RIVERA, Influence of the atmosphere on root development of some herbaceous plants.

Besides these articles the meetings held in the year 1922-1923 are reported, as well as a large number of official and other notices. (*Atti della Società Agronomica Italiana*. No. 5, Years IV and V, 1924, Aquila).

709. **The Drought Commission of the Union of South Africa.** – The evidence submitted failed to prove that the average annual rainfall had changed in recent times, but that owing to deterioration of the veld, to soil erosion, etc there was a reduced utility of rainfall. The main causes are overstocking of farms and veld-burning; the former deteriorates the fodder plants, and veld-burning seriously affects the run-off of water and assists soil erosion, a serious factor being the wind, which removes the unprotected surface soil. Owing to the rapid run-off excessive quantities of silt are being taken away by the rivers.

Afforestation is advocated both as a source of timber and for the protection of irrigation catchements; irrigation works are being seriously affected.

Organised propaganda is recommended and the education of the farming community in order to improve farming methods.

Soil conservation is regarded as so vital a matter that it is suggested that a Department of Reclamation be instituted. (*South African Irrigation Department Magazine*, Vol. III, No. 3. pp. 152-153. Pretoria, 1924).

710. **Western Australian Forestry's Report.** — The report refers to the work of the administration from July 1, 1923 to June 30, 1924. Details are given of one of the successful periods of forestry administration of Western Australia. However, it is to be regretted that the forestry reserves in Crown land are rapidly diminishing owing to general cultivation. It is still undecided if the Government will definitely assign certain areas as forestry reserves. (*The Australian Forestry Journal*, Vol. VII, No. 1, 1924).

Congresses and Conferences.

711. **XII International Congress of Agriculture, Warsaw, 21-24 June, 1925.** — Application has been made to the Secretariat of the Congress for a full report of its proceedings, but as that is not yet available, it is not possible at present to state the final conclusions or the resolutions passed by the five Sections among which the work of the Congress was divided. (See *R.* no 3, 462, 1925)

In the meantime the following account may be given of the main resolutions which accompanied the separate reports presented for discussion by Sections II, III, Va Vb, the work of which is cognate to that of this Review.

Section II: Plant Production. M. St. ZALINSKI concluded his report on the *use of gas and electric motors for agriculture*, by a proposal that the more extended use of these motors should be promoted by the establishment of electric workshops or of special schools and courses of instruction, that scientific research on the subject should be encouraged, and grants made to farmers, while the necessity of supplying combustibles at low rates should not be overlooked.

On the subject of *International phytopathological organisation* a communication was presented by MM. ET. JOEX and J. M. SAULNIER, who proposed, in regard to the projected *International Phytopathological Conference* that the programme of this Conference should be compiled by specialists, basing their recommendations on the final Act of the similar Conference of 1914, on the criticisms made of that Act and on the phytopathological legislation of the different countries. In addition, every nation should possess a State Service of Inspection for the protection of cultivated plants, organized directly for the purpose, and a sufficient number of Stations of Entomological Research and Plant Pathology, with proper provision of staff and equipment. Professor L. GRABOWSKI proposed the foundation of a periodical to be the organ of the International Association of the institutions for the protection of plants, and in particular to provide information on everything relating to potato scab. In connection with this disease Dr. A. KONECNY demonstrated the necessity for an International Convention and the establishment of an international commission with a view to the adequate solution of phytological problems of this character. Professor L. MOKRZECKI reported on the need for organizing in every country a service of protection of plants against harmful animals and weeds, and besides urging the training of an expert staff for the purpose, the establishment of chairs of applied entomology, and the standardising of legislation in the various States, he advocated the institution in each State of a Central Bureau of Plant Diseases caused by Insects, on the model of the Bureau of Entomology at Washington, which shall superintend all matters relating to the international control of animals and plants harmful to agriculture.

On the cultivation of lupins, reports were read by Dr. A. A. NEMEC, who explained the main questions which have still to be investigated in this connection, viz. lupins for seeding *versus* lupins for green manuring; the use of nitrogenous fertiliser or of ordinary manure, the exhaustion of the soil, and by J. SYPNIEWSKI on experiments with varieties with the shortest vegetative period, with hard seeds, with highest yield, showing absence of alkaloids, i. e. without bitter or poisonous substances.

On the economic use of phosphatic fertilizers according to the latest experiments important and detailed communications were made by M. BRUNA, Prof. E. GODLEWSKI Prof. D. PRIANISCHNIKOFF, Prof. J. STOKLASA.

Finally as regards the methods of drought control, M. H. KISZKOWSKI reported on the necessity of artificial irrigation for intensive cultivation and especially for vegetable growing and dwelt at the same time on the need for framing exact estimates for such irrigation at the time it was undertaken. M. J. P. REBELLO made a communication to the Congress on the same lines as previously given in Portugal, in regard to the "integral" method of cul-

tivation of cereals, that is to say the amalgamation of different methods of cultivation of wheat as a hoed crop and in conjunction with another plant, with good results as a measure of drought control

Section III. Animal Production. — The great importance of the local breeds from the point of view of the stock raising wealth of a country was the subject of exhaustive communications from MM. Prof. M. O. APENANDEZ, E. WARNANTS, and J. BRAILA, who formulated conclusions for the preservation of the breeds. Prof. J. JESPERSEN, Dr. H. MALARSKI, Dr. G. V. WENDT, dealt in turn with the problem of the *feeding of cattle*, in relation to rachitism occurring in the animals, to pastures, and to the content of the feeds in protein, mineral salts and vitamines: Ing. N. GOUIN, M. ROZICKI, A. APPEL and Dr. A. SCHMID reported on the *feeding of dairy cattle* from the point of view respectively of the estimation of the nutritive value of the different rations by the KELLNER method, of their " milk yield value ", according to the method of NIELS HANSSON, of the Testing Associations and their records of milk production, and of experimental breeding.

The problem of *horse breeding* was dealt with from the point of view of war experience by H. de THEULEGOET and by Col. E. C. MEYSEY-THOMPSON; in relation to Polish stock breeding by M. F. JURJEWICZ. Proposals relating to stock selection and the simplification of the respective methods were brought forward by Prof. PRAWOCHENSKI, E. VIBBENS, Prof. S. ULMANSKY, with special reference to registration in the herdbooks.

With reference to pisciculture in stew ponds, R. DE DROVIN DE BOUVILLE proposes that there should be standard regulations as to the biological and chemical conditions of the ponds and their temperature; Professor O. HAEMPEL that there should be chairs or Experiment Stations established for pisciculture, M. E. RUDZINSKI that the piscicultural associations should make a stand against the reduction in price of pond fish, with a view to securing an adequate profit on their breeding; Dr. F. STAFF that the international commission on agriculture should take steps to compile international statitics on freshwater pisciculture and moreover that it should go on to standardize the technical methods of breeding, etc.

On the subject of *animal diseases and on epizootic diseases from the point of view of international agreements for their control*, Prof. B. BANG and P. DECHAMBRE reported on tuberculosis; Prof. F. DE HUTYRA on tuberculosis, cattle plague, epizootic foot-and-mouth disease and contagious cattle pleuropneumonia, and Prof. S. MARKOWSKI on the standardisation of the control measures against epizootic diseases: while Senator A. MASSE proposed the immediate creation of a Permanent International Bureau for the Control of Epizootic Diseases, the drawing up of a standard type of veterinary health report to be published at the same date in the various countries taking part in this Bureau, or the publication of an international health report. Finally H. DE ROC, referring to the establishment in Paris on 25 January 1924 of the *Office international des Epizooties*, laid emphasis on the conclusions adopted in respect of cattle plague and epizootic foot-and-mouth disease, at the *Conférence internationale pour l'étude des épizooties* held also at Paris in May 1921.

Section Va. Agricultural Experiment. — In this Section Dr. J. CHMELAR and C. SCHREIBER presented reports on the methods of collective experiments

over long periods, bearing testimony to the value of such experiments from the side both of theory and practice, while Dr M. KOSTECKI made the proposal of inviting the International Union of Selected Seed Growers to publish periodically in their own organ the results of the comparative experiments carried out in different countries with varieties of improved plants. For the *international co-ordination of agricultural experiment*, J. JELINEK proposed in this connection the establishment of an international commission which should lay down the lines of the experiments to be made over a number of years, the standardisation of methods of research and an information service. For the international standardisation of methods of research the setting up of an Organising Commission was advocated by M. KOSINSKI, such Commission to consist of delegates appointed by the agricultural associations of France, Italy, Great Britain, Czechoslovakia and Poland.

Prof. MARCHLEWSKI and MM. J. JELINEK, J. POILVACHE and E. ROUX outlined the research work of the *Scientific Institutes for Agricultural Research*. In regard to *standardisation of the methods of analysis of fertilisers or of seeds*, Director K. DORPH-PETERSEN reported on the questions studied and the measures taken at the International Congresses on Seed Testing, held in previous years at Hamburg in 1905, at Munster-Wageningen in 1910, at Copenhagen in 1921, at Cambridge in 1924; Dr. W. J. FRANK reported on the standardisation of the testing methods; Dr. D. KNUTTEL on the method of the analysis of fertilisers; MM. E. VITEK and A. NEMEC on the establishment of an international commission which should standardise the methods of testing fertilising substances; Prof. B. ZALESKI on the testing of seeds from the point of view of international trade.

In this Section Mr. W. H. BEAL presented a communication on the *improvement of agriculture in America brought about by agricultural experiment*.

Section Vb. Agricultural Instruction. — Reports of a general kind were presented on the popularisation and diffusion of agricultural knowledge among the mass of the rural population by MM. P. C. CHANCRIN, S. JANKOWSKI, P. DE VUYST and M.me A. GRZYBOWSKA, dealing with the question in its various practical aspects, lectures, use of films, libraries, womens' farm organisations, etc. The subjects were then treated in more detail by MM. H. RADLINSKA, J. P. ZANEN, M.lle ROSINKIEWICZ, who dealt with the adaptation of primary school instruction, and of the curriculum of the training colleges for teachers to the needs of the rural population; M.me J. DZIUBKNSKA, Mr. R. MEYER and Drs. E. REICH and E. SAVOY dealt with the after school agricultural instruction; Dr. PRACH and M. SZYMANSKI with the vocational instruction of soldier agriculturists; Prof. S. PIETRUSZCZYNSKI and Dr. J. JELINEK with agricultural instruction in connection with the Institutes for Agricultural Research.

A report was presented by M. L. CHOWINSKI on the need for adapting the higher schools of agriculture to the requirements of the changed conditions of rural ownership, as due to the division of estates and the consequent institution of small independent agricultural units. MM. T. EVRARD, H. GIRARD and prof. C. ROGOISKI reported on the organization of apprenticeship in agriculture.

The last reporter suggested that for period of apprenticeship as an

experiment in education, the new programme of the Agricultural School re-cently founded and attached to the University of Milan, should be followed where a break in the studies is arranged after the fifth term and the time given to a practical apprenticeship of 9 months, during which period the pu-pil is under the supervision of the school and is obliged to draw up certain reports. A subsequent time of apprenticeship of 30 days falls between the sixth and the seventh term of school studies and a third period of 90 days between the seventh and the eighth term. For the apprenticeship are re-commended good farms with a normal agricultural yield

Mention should be made of a report by M. W. HOCHBAUM on the mea-sures taken to encourage agricultural progress in the United States by the Federal Department of Agriculture. Here is found a system of promotion of agriculture in its most varied forms, approved since 1914 by a Federal Law, adopted by the different States of the Union, and maintained by a fund of about 20 million dollars. The immense work which is carried on in this connection in the United States is accomplished by a staff of about 500 per-sons, of both sexes, who have special qualifications for work in connection with agriculture and who give instruction by demonstration methods to agri-culturists.

A resolution was passed unanimously by the members of the Congress that the next International Congress of Agriculture (the XIIIth) is to be held in Rome in 1927.

712. **Argentine : International Congress of Social Economy.** Buenos Aires from 26 october to 4th November 1924. The *Musee Social Argentino* has published part of the reports of the Committee relative to this Congress, con-taining the decisions, recomendations and subjects discussed at the General Meetings (*Premier Congrès International d'Economic sociale*, organized by the "Musée social Argentin", under the patronage of the Government, pp. 80, Buenos Aires, 1925).

713. **France : International Timber Congress at Lyons September, 1925.** — The resolutions proposed for discussion concern the general methods of forest protection, particularly in respect to commercial and industrial in-terests of the timber trade in France and abroad.

Reports have been presented on the following subjects: Forestry util-isations, woods, forestry labour and forestry associations; the use of pine-trees in the Landes; transport of timber by railroad and sea, the trade in colonial timber in France; the Syndicates for the guarantee of forestry en-terprises or works related to agriculture.

714. **Italy : International Road Congress at Milan. September, 1926.** — More than 50 States will take part in this Congress, which will be completed by an important International Exhibition on roads The Exhibition will illustrate most progressive methods of constructing and maintaining road-ways in towns and in the country. The methods of administration will be similar to those adopted by previous International Congresses (Paris 1908, Brussels 1910, London 1913). The Exhibition will be under the patronage of the Municipality, the Province and the Chamber of Commerce of Milan

715. **Portugal : Science Congress at Coimbra, June, 1925.** — The Con-gress was organized by the *Asociación Española para el progreso de las Cien-*

1925 in agreement with the Portuguese scientific Association. An exhibition of scientific apparatus was held.

716. **France: Congress on the Colonial Customs, Marseilles, June 1925**, organized under the auspices of the Colonial Institute at Marseilles with the object of studying the revision of the French colonial Customs system and how this revision could be applied.

717. **France. Congress at Grenoble of the "Associations Française pour l'Avancement des Sciences".** 27 July-1 August, 1925.

718. **Algeria. Congress of Wheat Growers of Northern Africa, Algiers, 12 to 14 January, 1925.** — At the wheat Congress held in 1922 at Marseilles a form of contract for the selling of Algerian corn had been agreed upon. This Congress took place on the occasion of the French Colonial Exhibition under the auspices of the Colonial Institute of Marseilles and was attended by the National Mills Association and the "Fédération Intersyndicale de la Minoterie et de la Semoulerie" of Marseilles. The Congress of last January at Algiers was especially occupied with the problem of modifying the form of this contract.

719. **Italy. XIXth National Congress of Travelling Professorships of Agriculture, Rome, April, 1924.**

720. **First National Forestry Congress, Rome, May, 1925.**

721. **Conference on Agricultural Research, Rome, April, 1925.** — Amongst those present were: Prof OTTAVIO MUNERATI, Director of the Royal Sugar-Beet Station of Rovigo; Prof. ANGELO MENOZZI, Director of the Royal Technical School of Agriculture, Milan.

722. **Congress in Celebration of the 25th Anniversary of the Travelling Professorship of Agriculture in the Province of Syracuse; Syracuse, 5-7 April 1925.** — Papers read: The travelling Professorship of Agriculture for the province of Syracuse in the first quarter of a century of its foundation (Prof. N. DI MATTEI); The control of the white-red disease of acid fruits (oranges and lemons) (Prof V. MEZZASALMA); Vineyard protection (Prof S. MONTONERI); The improvement of yield of the carob tree (Prof. F. CASTRO); Almond-growing in Sicily (Dott. G. SAVASTANO); The importance of herbaceous plants in the Noto district, from a technical-economical standpoint (Prof. S. MARISCALCO); The meadows of Modicano in respect to the form and evolution of local cattle (Prof V. PEDIGLIERI); The planting of oriental tobacco in the province of Syracuse (Prof M. PICCITTO); Agriculture in the province of Syracuse (Prof. S. ODIERNA). For information apply to the: Cattedra Ambulante di Agricultura, Syracuse (Sicily).

723. **000. Italian Wine Day at Milan, April 24, 1925.** — This Day was organised by the Commission for the Protection of Italian Wine, on the occasion of the International Sample Fair. The chief speakers were: Professor L. MESSEDAGLIA: Exaggerated medical and hygienical measures against the use of wine; G. BIONDI: Propaganda and publications in favours of Italian wine; Prof MARESCHALCHI: The necessity of propaganda and protection abroad for Italian wines.

724. **Italian Winemakers Day, Milan, 22 April, 1925.** — Amongst the papers read were: Enology and the consequences of reforms in technical schools for wine making (DE ROSSO), Specialist in wine-growing; Technical specialists in the association for the protection of wine-growing (Prof. A. MORETTI); The

technical wine specialists in the associations and in the wine cellars of the Associations (A. DA RIOS).

725. **Italian Wine Conference. Milan, 20-27 April 1925.** — This Conference took place on the occasion of the International Sample Fair and under the auspices of the "Unione Italiana Vini". The papers read included Credits on wines, and cooperation (G. FRIEDMANN); Duties, Customs and taxes, (Doct. L. BRANCOLINI); Legislative measures relative to fraud and typical wines (Prof. TEDESCHINI); Transport by railroad and sea (Avv. C. CAVAZZANA); Export of wine (F. FOLONARI); Customs treaties and new markets (Prof. A. MARESCALCHI).

726. **XIVth Meeting of the Italian Association for the Progress of Science, Pavia, 24-28 May, 1925.** — Among the papers read on agricultural science were the following: Light as a detrimental factor of plant life (Prof. G. GOLA); Libian flora (Prof. F. CAVARA); Rice-growing from an economical point of view (Prof. N. NOVELLI); Artificial Lakes (Prof. G. GANASSINI). For information apply to the Istituti Biologici (Palazzo Botta), R. University, Pavia.

727. **Mexico: First Congress of Stock Breeding and Veterinary Hygiene, Mexico, 8-28 November 1924.** — The Congress was divided into 3 Sections: Stock breeding, sanitary hygiene and medicine. In a general meeting the following subjects were discussed: tuberculosis, epidemic foot-and-mouth disease, piroplasmosis, compulsory vaccination of dogs against rabies, the vaccine-serotherapy against swine cholera; nutrition of milch-cows and sanitary laws relating to cattle. Papers were read also by Dr. D. FERNANDEZ, Professor of Pathology at the School of Veterinary Medicine of Mexico on the curing of mastitis of dairy cows, and Dr. S. MACIAS VALADEZ on the chief parasitical skin diseases.

Exhibitions, Fairs, Competitions.

728. **Germany: International Fair at Frankfort; Spring Meeting 1925. General Fair from April 19-25; Technical Fair from April 12-22, 1925.**

729. **Argentine. IVth International Live Stock Show at Palermo, Argentine, September, 1924.** — This exhibition was organised by the *Sociedad Rural Argentina*. The annuals of this Society published a special number (No. 19, October 1924) for this Exhibition in which are shown excellent illustrations of the cattle exhibited.

730. **Switzerland: International Fair of Colonial and Exotic Products, Lausanne, from 27 June to 12 July, 1925.** — The Exhibition was divided into 6 sections: I. the food products of agriculture and of the sea; II. non-food products of agriculture and of the sea; III. horticultural, arboricultural and allied products; IV. forestry products; V. subsoil products; VI. Miscellaneous, Colonial arts, etc.

731. **Germany: Sugar-Exhibition, Magdeburg, 23 May to 7 June. 1925.** organised by the "Vereins der Deutschen Zuckerindustrie" together with the "Verein deutscher Zuckertechniker". The Exhibition took place on

the occasion of the 75th anniversary of the "Verbände der deutschen Zucker Industrie". During the Exhibition period the chief German Associations connected with the sugar industry held Congresses at Magdeburg.

732. **Argentina: Cotton Congress, Corrientes, September, 1924.**

733. **IIIrd Agricultural Exibition; Competition for Dairy Cows; Exhibition of Pure Seeds; Argentina, 18 to 26 April 1925,** organised by the *Sociedad Rural Argentina.*

734. **United States: A Rubber and Tropical Products Exhibition** will be held at Boston, Mass. from October 10 to 17, 1925. Sections will be devoted to rubber, textiles, coffee, cacao, tea, vegetable oils, fats and waxes, hides and tanning materials, sugars, fruits, timber and dye woods, minerals, touring and travel. (*Bulletin of the Pan-American Union*, Octor, 1924)

735. **United States: National Exhibition of Chemical Industries, New-York from 28 September to 3 October, 1925.**

736. **Cuba: Stock Breeding Exhibition, Havana, 1926.**

737. **Poultry Exhibition, Havana, Cuba, February, 1925.**

738. **Tunisia: General Exhibition of Horticulture and Forestry, Tunis, April 1925.** — The Exhibition consisted of two divisions: horticulture and forestry. The last group was organized by the aid of the "International Society of Tree-friends" at Tunis, and was divided into three sections: seeds and plants; forestry products; publications on forestry matters.

739. **France: General Competition of Autocars and Gas-generators, France, 15 September, 1925.** organized by the *Scientific Petroleum Commission* under the patronage of the "Office National des Combustibles liquides", the "Office National des Recherches et Inventions," the "Automobile Club" of France and the Ministry of War. A Special Committee was appointed for the preparation of the programme, with M. KOENIGS (Member of the "Institut" and Professor at the Faculty of Science, Paris) as President. The competition was held in the North of France and covered a distance of 200 kilometers.

740. **Italy: Competition for the Smaller Agricultural Industries and Manufactures of Italy.** — The Institute for Small Industries, at Bolzano, has given notice that a prize competition has been opened for small rural industries and manufactures, under the protection of the Royal Venetian Institute of Science, Letters and Art.

For information apply to the R. Instituto Veneto di Scienze, Lettere ed Arti, Bolzano, Piazza Domenicani, 1.

741. **Uruguay: Exhibition of Agricultural Products. Montevideo, 19 June, 1924.**

Development of Agricultnre in Various Countries.

742. **Germany: The Situation of German Agriculture at the beginning of 1924.** In a report presented in February 1924 by the German Government to the Experts-Commission, a section of the Reparations Commission, statistical information was given respecting the economic-financial situation of Germany (Material für ein Studium von Deutschlands Wirtschaft, Währung und Finanzen). For the work of the Experts Committee

further details on the agricultural situation of the ex-Empire proved necessary and these were furnished by the German Agricultural Council Deutsche Land-wirtschaftsrat). These notices formed the second number of the publication of the Agriculture Council (Veröffentlichungen nº 2). The publication is divided into 8 chapters, the first of which is an introduction by Dr. BRANDES, Economic Adviser and President of above Council; the second chapter contains the Statement which Baron von WANGENHEIM KL. SPIEGEL President of the Official German Agricultural Commission had already presented to the irst Commission of Experts. This Statement has served as a basis for collection of data; a third chapter treats of food conditions in Germany, which had been discussed by the Economic Adviser before the 1st Commission of Experts. The following five chapters give a general description of the condition of German Agriculture at the beginning of 1924; the productive capacity of German Forests according to the German Forestry Council (Reichsforstwirtschaftsrat); the output of German Farms from the year 1914; agricultural Capital and Credit in Germany; the agricultural fiscal taxes.

The publication forms a complete statement, illustrated with diagrams and figures, of the conditions of German Agriculture especially in the first five years after the War (Materialien zur Beurteilung der Lage der deutschen Landwirtschaft zu Beginn des Jahres 1924. Vorgelegt bei der Beratungen der Vertreter der Landwirtschaft mit der I. Internationalen Sachverständigen Kommission am 11ter Februar 1924. *Deutscher Landwirtschaftsrat.* Veröffentlichungen nº 2, pp. 51, 8º; diagrams. Berlin, 1924).

743. **Brazil: Official Data on Brazilian Agriculture.** — The volume contains data supplied by the Brazilian census of September 1920 in respect to agriculture and industry in the Federal District. This publication, the 2nd part of Vol. II of the complete Statistics of the census, contains in regard to agriculture the following data: the areas and value of farm properties, the class of farmer and nationality of the owners, the systems adopted on the farms, the number of cattle, the agricultural, forestry and cattle production, rural machines and implements. Coloured plates show the types of poultry reared in the districts of Engenho Novo, Engenho Velho e Jacaperagua (Orpington and Rhode Island breeds, etc.)

(Ministerio da Agricultura, Industria e Commercio. Recenseamento do Brasil realizado em 1 de Setembro de 1920, volume II, part 2ª, Rio de Janeiro, o 1924).

744. **United States: The National Forest Reserve of New-Hampshire, U. S. A.** — The *National Forest Reservation Commission* has added 21000 acres to the *White Mountain National Forest*. The Governmental Forest Reserve now contains 462,200 acres, representing an investment of $ 70,000. It is proposed to increase the area to 960,600 acres. (*Science*, vol LXI, No [illegible], 1925).

745. **Sudan: The Development of Cotton-Growing in Anglo-Egyption Sudan.** — The work has been completed for the Makwar dam on the Blue-Nile near Sennar (Anglo-Egyptia Sudan) in connection with the irrigation of large areas of land for cotton growing. Drainage works are also being completed in the Gesira plain. The Makwar dam will have a length of 3025 metres. The reservoir will have a length of [illegible] kilometres. The canal

made through the Gesira plain will have a lenght of 15,000 km. Thus altogether an area of 300000 *feddan* (1 feddan = m² 4200.83) will be irrigated. The cost of this important enterprise hasn bee estimated at £ 13,000,000. The development of the irrigated area will be chiefly undertaken by the *Sudan Plantation Syndicate*. The Sudan Government and the native growers will take part in this development. Pending the completion of the work about a fifth of the area has abready been planted with cotton. The water is supplied by suction pumps. (*La Dépêche coloniale*, November, 1925, and *Bollettino di informazioni economiche del Ministero italiano delle Colonie*, year XII, No. 6, 1924).

746. **East Africa: Tea Enterprise in Kenya Colony.** — Tea planting on a commercial scale is now taking place in Kenya Colony: two large firms have purchased estates in the highlands, at Kericho and Limoru. The Limoru firm proposes to make agreements with estate owners, who will receive tea seed and expert assistance; the firm will receive the produce for fifteen years, and will manufacture and dispose of the finished tea. (*East Africa*, Vol. I, No. 5, p. 140. London, 1924).

747. **Australian Irrigation Scheme.** — The first section of the Dawson Valley irrigation scheme has been officially opened by the Governor of Queensland. The dam will have a lenght of 800 feet; the reservoir will have a storage capacity of 2,485,000 acre-feet and will supply water for 200000 acres of agricultural and 2000000 acres of pastoral land, all of which is at present unused. The cost will exceed £ 2 000 000. A hydroelectric station at the dam will generate power to supply light, power and water for the whole area. (*New Reclamation Era*, Vol. 15, No. 10, Washington, D. C., 1924).

748. **Italy: Improvement of Grasslands and Pastures of Mountain Communities in Italy.** — The problem of improvement of forestry properties of Mountain Communities may been greatly assisted by the favourable conditions granted by the Royal Decree of December 30, 1923. On behalf of many communal administrations the "Italian Communal Association" has approached the principal credit institutions in Italy, asking for financial assistance for carrying out the projects relative to the improvement of grassland. The communities interested are undertaking these improvements on their own initiative or through the *Secretariat of the Mountains* (Segretariato della Montagna). (*L'Italia Forestale*, Year VII, No 13, 1925).

749. **Russia: Agricultural Progress in Russia.** — A paper read by M. A. I. RYKOV at Tiflis at a meeting of the *Central Executive Committee of the Union*, gives an account of the restoration of Russian Agriculture. The area sown in 1923-24 was 80 % of that sown before the War, in the Ukraine it even amounted to 97.5 % and in Siberia 96.1 %. It is due to the famine of 1921 that the area sown has not fully reached the pre-War standard. It is important to note how Agricultural progress in the year 1923-24 has been chiefly connected with crops having the highest market quotations. Similar improvements were also noted from a stock-breeding standpoint. For instance, in 1924 the number of horses was 70.8 % of that 1916; the number of cattle 93 %; sheep 83 % and pigs 87 %.

The Government has spent 83 million roubles for the support of agriculture in the areas where the harvest was poor. The harvest of 1924 was only one-

quarter less than the harvest of 1921. Great care had been taken to provide the peasants with a sufficient quantity of seed in the spring and in the autumn. Unfortunately the weather conditions in the winter spoiled the autumn crops. The Soviet Government has therefore given an additional subsidy of 7,500,000 roubles.

In connection with the progressive consolidation of the Russian finances there will be a partial remission of agricultural taxation and schools for agricultural instruction will be increased. In his description of the rural situation, RYKOV remarks on the progress in the economic and intellectual conditions of the peasants. The Government has undertaken to direct the rural affairs and to take part in the activity of the local Soviets, and also in the co-operation of agricultural producers and consumers. (*The Soviet Union Review*, Vol. VII, No 12, 1925).

750. **Czecho-Slovakia: Note on Czecho-Slovakian Agriculture.** — *Seed selection* is carried out successfully by individuals as well as by the Government. The Government lays much stress upon the production of pure seed, and controls the seed trade, and organized Experimental Stations, such as the Moravian Experimental Institute at Brno, the Experimental Station at Dobrovice the Sugar Experimental Institute at Prague, etc., and others are being organized. *Horticulture :* The output is considerable in the valleys and on the plains.

Large quantities of vegetables such as garlic, cauliflower, tomatoes, etc. are imported. Preserved tomatoes and vegetables are made only for home consumption. *Fruit-growing :* As the output largely exceeds the demands of home markets, there is an important fruit-export. The heavy output, together with the large national sugar production have brvought about an extendsive industry for fruit preserving, jams, etc. (about 325 factories).

Flax and Hemp : Not yet fully developed; about 500 factories, the most important of which are : the factory at Kuchelna (largest in Central-Europe) and that of Jindhichův Hradec.

Hop growing : the hops of Zâtec-Saaz are well known. A law regulating the exportation of this hop has been passed. The production amounts to 400 000 420,000 q. per year and the annual exportation varies from 30 000 to 70 000 q.

Tobacco-growing is not of great importance, but the area has increased from 1254 hectares in 1921 to 4,152 hectares in 1924.

Floriculture has improved, expecially during the years of the War. New firms have been established for flower growing, chiefly for export. The gardens of Pruhcnice near Prague and those of Mlynany in Slovakia are well known.

Forestry : Checho-Slovakia is one of the most heavily forested countries of Europe (4,663,663 hectares of forest cover 33 % of the total area the country). The timber production amounts to about 15000000 cu. metres. There are 800 modern saw-mills driven by steam or electricity and 1853 hydraulic saw-mills : 640,000 cu. m. of timber are exported. The greater part of the forests are private property but the Government is preparing a scheme of forest nationalization.

Food-product industries : Besides fruit, vegetable and canned meat, there are factories for the preparation of preserved pickles, fish, chocolate, etc.

Potatoe-industry : Carried on chiefly in the higher plains. Distilleries, starch-factories, etc. are mostly cooperative industries.

Distilleries. — Number about 1000 and are connected with the farms that supply the raw material (especially potatoes) to which are returned the waste products. Here are also about 70 industrial distilleries that produce ethyl alcohol from molasses, maize, etc. The total annual supply of alcohol is regulated by the State, and amounts to 50 0000 hectolitres. As the production of alcohol is excessive the Ministry of Finance has prohibited the manufactur of fruit-alcohol.

Malt Industry : The growing of barley and the improvement of this cereal has received much attention. The malt industry has 170 factories which annually deal with 400 00 q. of barley (20 % of this is home grown). (*Publication du Ministère de l'Agriculture de la République Tchécoslovaque*, Prague, 1 March, 1925).

Miscellaneous.

751. **The Worlds Rubber Position.** — A concise pocket manual containing statistics relative to each country's import and export of rubber; directory of merchants, brokers, dealers and manufacturers; market prices, average fluctuations, etc. (Published monthy, by W. H. RICKINSON and SON, 3 Great Winchester Street, London, E. C. 2.)

752. **The Anti-opiumActivities of the League of Nations.** — In the International Meetings called together by the League of Nations in order to limit the production of alkaloids, a proposition, presented by the French and British Governments on the limitation of the use of opium in the next 15 years has been adopted. The agreement was signed by the following States : France, Great Britain, Italy, Japan, Holland, Portugal and Siam.

The second meeting on opium suggested a scheme for protocols to regulate the production, supply and export of opium. (*Résumé mensuel des travaux de la Société des Nations*, February and March, 1925).

753. **New Process for Removal of Acid from Oils and Fats.** — By this process oils are treated with a compound which rapidly separates the constituents of the oils into two groups, viz: neutral oil and fat, and fatty acids. The treatment is carried out in aclosed apparatus. The cost of the above-mentioned compound is higher than that of an alkali which serves for the removal of acids from oils of law acidity. The new process requires the employment of steam, the expense of which may be compensated by the saving effected in deodorization, which will require much less time in this case than when an alkali is used for the removal of acids. In this way the capacity of the deodorization machines now in use would be very much increased. The cost of installation of this process is however very high and would therefore only be suitable for refineries that use oil with a high percentage of fatty acids. (Communication received by the International Institute of Agriculture).

754. **A German Agricultural Delegation in the United States of America.** — This delegation left Bremen on April 2nd for the United States in order to study agricultural conditions of the last ten years. The Commission will stay in the United States for about 6 months and is composed of the following delegates: Dr F. BRINKMANN, Professor of rural economy at Bonn; Dr F. ROEMER, Professor of plant genetics at Halle; Dr KEHNE

specialist in farm engineering ht M nich and J. ICHE a land owner and ex-Director of the stock-breeding section of t e G rm n Ministry of Agriculture. The delegation will be officialy accompanied on its tour by the Under-Secretary of Agriculture. Dr. F. HAGEDORN, appointed by the Department of Agriculture at Washington. (*Science*, VolLXI, No. 1580).

755. **Brazilian Oil Palms.** — Sig. ARMANDO MENDES has published a study on these palms (more than 40 varieties) in the *Brazil-Ferro-Carril* of the present year. The possibilities are shown of the oil-industry in Brasil. Most of these trees were derived from the States of Amazona, Pará, Maranhão Piahuy, Bahia, Pernambuco and also from Minas Geraes, S. Paulo, Rio de, Janeiro, Alagoas, Rio Grande do Norte and Matto Grosso.

The author considers especially the " babasou " (*Orbignia Martiana*, Barb. Rodr.) ; the " bacaba " (*Oenocarpus distichus* Mart.) ; the " bossu " (*Manicaria saccifera*, Gaertn.) ; the " burity " (*Mauritia vinifera*, Mart.) ; the " Carnauba " *Copernicia cerifera*, Marth. and *Corypha cerifera*, arruda) ; the " Curuà " (*Attalea spectabilis*, Mart.) ; the " dende " (*Elalis Guineensis*, *Laeq*) ; the " inaja " (*Maximiliana regia* Mart.) ; the " inayuca " (*Maximiliana speciosa* Mart.) ; the " inadaya " (*Attalea humilis*, Mart.) ; the " Farina " (*Phytelephas Macrocarpa*, Buiz and Pav.) ; the " pasciuba " (*Iriartea Orbignyana or I. exorrhiza*, Mart.) the " piassava " (*Laopoldina Piassava*, Mart. and *Attalea funifera* Wall) ; the " pindola " (*Attalea Compta*, Mart.) ; the " tucuman " (*Astrocaryum Tucuman*, Mart.) and the " urucury " (*Attalea excelsa*, Mart.) (ARMANDO MENDES Palmeiras do Brazil productoras de oleos. Grandes possibilidades para esta nova industria. *Brasil-Ferro-Carril*, Year XVI, Vol. XXVIII Nos. 381, 382, 383 384, 385, 386, 1925)

756. **Brazil : Report on the Progress of Agriculture in Brazil** — Dr. DEOCLECIO DE CAMPOS, Brazilian Delegate at the International Institute of Agriculture in Rome, has taken the initiative in describing the progress of Brazilian Agriculture, with a view to improving the relations between the above Institute and Brazilian scientific men, specialists in agriculture and economists. Dr. de CAMPOS has arranged that monographs, essays and original articles on one of the many technical and scientific questions of agricultural economy, written by Brazilians, should be forwarded to him. Such works will then be examined by competent officials of the International Institute of Agriculture, after which they will be brought to the knowledge of wide international circles interested in agriculture, by publication in one of the reviews of the International Institute.

The problems selected will treat of the various aspects of Brazilian agriculture and will be either of general character (irrigation, the use of fertilizers, experiments in agriculture, forest reserves) or of a more special type (oil plants, medicinal plants, cotton, growing, rice, rubber-planting, sugar, manioc, cattle breeding, food-stuffs industries. (*Brasil-Ferro-Carril*, Year XVI, Vol XXVIII, No. 391, 1925).

757. **Meat and Coffee and their Relation to the Export-Trade of Brazil.** — Dr. ALFONSO COSTA, Director of the *Service de Informações* do *Ministerio de Agricultura, Industria e Commercio* of Brazil has published a study on the export of Brazilian products to France, Great Britain and Germany. The important chapters of this study are those that treat of coffee and of

meat. The chapter on coffee, which contains statistical data, points out how France and Germany promise to become excellent markets for the Brazilian product, while the import of coffee to Great Britain has diminished. It is to be noted however that the import of coffee of other than Brazilian origin has diminished on the British markets.

In the chapter on the frozen meat trade Dr. COSTA gives a comparative study of the world-consumption of this product. It is however stated, that the Argentine Republic takes the first place on the French, British and German markets as to frozen meat. But after coffee, frozen meat is of the greatest interest for the Brazilian export-trade to France. On the British market however it cannot compete with Argentina, Australia and Uruguay. The export of meat to Germany has only been carried out since 1921, but this country promises to become a good market for this Brazilian product. (ALFONSO COSTA. Exportação de carnes. *Ministerio da Agricultura, Industria e Commercio, Serviço de Informações*, pp. 12, Rio de Janeiro 1925; *idem*. O café. *Ibidem*: pp. 22, Rio de Janeiro, 1925).

758. **Hygienic Organization in Brazil.** — A report has been presented by Dr. MARIO PINOTTI, of the "Sanità Pubblica" of Brazil to the "Accademia di Medicina" in Roma. The author gives a short description of the progress made by the State in the field of social medicine. The development of the present work on hygiene in Brazil is largely due to the fact that the Manguinhos Institute is one of the chief centres of medical research in South-America. The Rockefeller Foundation has also given encouragement to the organisation of Brasilian Hygiene. In 1918 under the Government of EPITACIO PESSOA the "Departemento Nacional da Saude Publica" was founded. This Department consists of three divisions the, (1) maritime (2) land and (3) rural. The last one has an economic-social importance. The expenses, for the organization of hygiene are covered, one half by the Provinces (which are self-governing) and the other half by the Central Government. The budget for each province will probably amount to 1400000 lire yearly. In 1924 the Direction for rural hygiene functioned in 18 Provinces and in the Federal District and a sum of 26000000 lires was expended. The Federal Government nominates the Chiefs of the Service and their assistents. The Commission delegated by the Division for rural hygiene to each province begins with the preliminary work of distributing sanitary information to each community. The data collected form the basis for a classification of these Communities in respect to their sanitary and economic conditions. The funds available allow a certain number of communities to be provided with the necessary sanitary establishments that are fitted up as prophylactic stations. The staff appointed to each establishment is composed of: a chief Doctor of medicine, a microscopist, a secretary, an attendant and as large a number of nurses as possible for visiting purposes.

Dr. PINOTTI discusses what has been accomplished in Brazil, especially in respect to malaria, anchylostomiasis and venereal diseases.

(Dr. MARIO PINOTTI. The Brazilian Hygienic Organization. Report presented to the Academy of Medicine, Rome, at the Meeting held 18 February 1925, 21 pp. Rome, 1925).

759. **Brazilian Inquiriy on the Increase of Prices.** — In the *Gazeta da Bolsa* (Year VIII, No 6, Rio de Janeiro, 1925) an account is given of the decisions made and which were sent to the Inquiry-Commission of the "Associação Commercial do Rio de Janeiro" on the increase of prices in Brasil. The questionnaire and the answers discuss the following subjects: technical questions, rural sociology and economy, agricultural and cattle breeding instruction, development of stockbreeding, agricultural credits, division of the soil after the North-American and Argentina system, importation of agricultural machinery, model-farms, installation of refrigeratories, bread making, fishing and hunting regulations, small regional markets, regulation of national and foreign immigration and reorganisation of the Military Service in respect to the agricultural requirements.

760. **The Metric System adopted by Canada.** — The metric system was officially adopted by the Canadian Government in July, 1924. A period of ten years has been allowed for the education of the public in the use of the system. In the meantime the Government will use the new system in their official figures and statistics. (*South African Journal of Industries*, Vol. VII, No 12. Pretoria, 1924).

761. **The British Sugar Beet Industry.** — As a result of the beet sugar subsidies the following companies have been formed: The Ipswich Beet Sugar Factory Ltd., capital £. 300 000, to serve growers in South Suffolk and Essex; capacity, 1 200 tons of roots per day; ready in October 1925. The West Midland Sugar Co. Ltd., will erect two factories, each of which will deal with at least 1000 tons of roots per day; allowing for working capital, the cost of each factory will be £. 500 000. The Bury St. Edmunds scheme, half the cost of which (about £. 350 000) will be subscribed by Hungarian capitalists, will have its factory ready for the 1925 season; the factory capacity will be about 1500 tons of roots per day. (*The International Sugar Journal*, Vol. XXVII, No 313, London, 1925).

762. **An Improved Method of Transplanting Young Trees.** — *The South-African Journal of Industries* (No. 2, vol. VII, 1924) describes a method for transplanting young trees in order to avoid damage from the sun and so that it will not be necessary to water them excessively when transplanting. Mr. J. A. GRANT from Duivel-Kloof in the Transvaal has invented a machine called the "Duivel Tree Planter" which works on the following principle; the earth around the young plant in the nursery is removed, together with the young tree and is then transported without damage to the roots. The method is to place a cylinder (driven down completely to the roots) around the young tree and then to transport the cylinder and tree to the site chosen for the replanting.

763. **Land Reclamation in Italy.** — During the discussion on the Finances of Public Works in the Senate, Minister GIURATI has declared that land-reclamation is particularly important for Southern-Italy. Works of this nature carried out up to the present time amount to 33[illegible] 000 hectares, and a further 12 200 000 hectares are being improved, or are in a state of advanced preparation. These reclamations will cost 1083 million lire. Besides the work's completed, reclamation projects for another 112 000 hectares are being con-

sidered and it is expected that requests for a further [illegible] hectares will folow.

764. **Internal Colonization in Italy.** — In the periodical *La Terra*, the Hon. Senator EDOARDO PANTANO has published two articles on internal colonization. Senator PANTANO is an authority and an advocate of internal colonization. In the first of his articles the points out the economic, financial and administrative basis of a "National Institute for Internal Colonization". The project for this Institution as it has been presented by Sig. PANTANO to the Italian Senate, was published almost in full in the last edition of the present Review. In the second article the author presents ideas in favour of facing the land problem in Italy, as it has already beeen done in other countries. The results of the Inquiry by the Ministry of Agriculture in 1917-1921, although they were incomplete, state that in Italy large estates are gradually being converted into small holdings. But in order to expedite this transformation and to develop rural co-operative movements, co-operative leasing of land, individual reclamation, etc. it is necessary to obtain the support of the Government (EDOARDO PANTANO, "La Colonizzazione interna". *La Terra*, Year 1, No. 3, 1925. "L'Esempio degli altri in Tema di colonizzazione interna". *La Terra*, Year 1, No. 4, 1925.

765. **Holland : Tea Planting in the Dutch-Indies during a Century (1824-1924).** — On the occasion of the Tea Congress and Exhibition at Bandoeng the Tea Experimental Station (Proefstation voor Thee) published a retrospective monograph on tea planting in the period 1824-1924. (*De Indische Mercuur*, Year 48, No. 10, 1925).

766. **Roumania : Monograph on Agricultural Costing.** — The Inspector General of Agriculture of the Roumanian Ministry of Agriculture, P. ROSIADE, has written a monograph on agricultural costing, which is a practical publication of about 70 pages, divided into two sections. The first chapter deals with the nature and origin of agricultural costing, development and organisation, importance from a scientific point of view, the use of statistical book-keeping and the practical application of book-keeping methods. The second chapter treats of agricultural costing in different countries. Then follows a description of the organization of the Institute of Rural Accountancy and Economy of Czechoslovakia, together with details of the models and methods employed by this Institute. (P. ROSIADE. Oficine de Contabilitate Agricola. Expunere monografica Ministerul Agriculturii si Domenilor *Directia Statisticei Agricole, sia Publicatiile Supplemente a Buletinul agriculturii*, Vol. IV, pp. 71. Bucharest, 1924).

767. **France: Cyanamide Production in France.** — In 1923 cyanamide was produced by three establishments (Bellegarde, Marignac and Brignaud). In 1924 more factories were established and it is estimated that the total output of French cyanamide in 1924 amounted to about 90 000 tons, equal to 18 000 tons of nitrogen. (*Industrial and Engineering Chemistry* Vol. 17, N° 1, 1925).

768. **Morocco : The Sale of Morocco Phosphate in 1924.** — The sale of phosphate amounted to 430 340 tons, half of which was taken by France and Spain (respectively 113 476 and 108 504). Then follows Holland with about [illegible] tons, Denmark 33,000, Belgium 11,000 tons. Other European States

have imported considerably smaller quantities. (*Rassegna mensuaria [illegible]-gica e chimica*, Year XXXI, Vol. LXII, No. 2, 1925).

769. **France : Protection of Antartic Fauna.** — The French Government has issued a decree for the protection of antartic fauna in a " National antarctic Reserve " in territories belonging to France, on the Islands of Crozes, S. Paolo and Amsterdam, and in northern and southern Kergaelen Land on some small islands. Within the boundaries of these areas the killing of whales, seals, etc., is prohibited. No special measures are taken for enforcing this decree, which depends entirely on the good faith of the fishermen in these seas. (*Nature*, Vol. 115, N° 2893, 1925).

770 **Portugal. The Discovery of the Alkaloïds in Quinine.** — In the *Revista della Chimica pura e applicada* (Nos. 5, 4, 6; 1924), the organ of the "Sociedade quimica portuguesa" is an article of Prof. ALBERTO DE AQUIAR, devoted to the memory of Dr. BERNARDINO ANTONIO GOMEZ, a Portuguese medical doctor who lived from 1768-1823. In the year 1812, 8 years before quinine was discovered by PELLETIER and CAVENTON, he published an article in the *Memorias da Academia* (Vol. 3, 1812) entitled " Ensaio sobre o cinchonimo e sobre a sua influencia na virtute da quina e de outras cascas ". The discovery of GOMEZ was also published in the British Press of the time. The basic qualities of the cinchona tree, indicated by the Portuguese doctor were then examined in the laboratory of THÉNARD and communicated to PELLETIER and CAVENTON. During the years 1905 and 1911 the " Academia Real das Sciencias " has received information regarding GOMEZ, from Visconde DE VILA MAIOR and Dr. EDWARD AUGUST MOTA.

771. **Nitrogen Fixation in Czechoslovakia.** — The Government proposes to erect new factories for the fixation of nitrogen in the centre of the country, as the present factory at Falkenau, directed by the " Aussig Chemische Verein " is very near the frontier. A Ministerial Commission has proposed to increase the working capacity of the factory at Falkanau to 30000 metric tons of fixed nitrogen annually in order to supply the requirements of agriculture. The Commission also proposed that a factory be established at Mahrisch-Ostrau for the preparation of sulphate of ammonia from the by-products of coal gas and of the by-products from the fixation of atmospheric nitrogen. The creation of a hydro-electric establishment for fixation of nitrogen is proposed at Shechowik (*Chemistry and Industry*, Vol. 44, No 17, 1925)

Journals and Reviews.

772. **Germany.** — The *Illustrierte Landwirtschaftliche Zeitung* has published a special number on potatoes (No. 11, 1925). This *Kartoffel Sondernummer* contains articles by Dr. L. W. RIES on the use of implements in weeding ; by the agricultural expert G. SCHALK on the possibility of doubling the yield of potatoes ; by Prof. APPEL, Director of the State Biological Institute at Berlin-Dahlem, on the measures for prevention of abnormal sprouting of the potatoes ; by Prof. Dr. O. HEUSER on the degeneration of potatoes and preventive measures ; O. STAUDTE, of Breslau on the Fertilization or Pollinization of the Potato flower ; by Dr NICHTWEIS agricultural adminis-

trator in Silesia on the methods of storage of the potato by the construction of special store-houses; by Prof. OPITZ of the High School of Agriculture in Berlin, on the influence of fertilizers in potato-planting. In addition there is an article by Herr KNORR of Vornstedt (Mark) on the annual report of the German Potato Research Station (Deutsche Kartoffelkulturstation) and the results reported therein concerning the inquiries of that Station during the year 1924; an article by H. MORGEN of the Agricultural Institute of Giessen on the percentage of starch in relation to the successive production of the same variety of potatoes through succeding generations; by Mr KOHLMEIER of Mecklenburg on the determination of the forms of tubers of potatoes. The articles are illustrated. The usual supplement to the *Illustrierte Landwirtschaftliche Zeitung*, the *Blätter für die deutsche Hausfrau* is also devoted to potatoes in this number.

773. **The "Deutsche Bergwerks-Zeitung"** has recently entered its 25th year and has issued special illustrated publications with detailed information on German steel mining industries. The first numbers of this special publication give a survey of the German mining industry.

774. **The "Kolloïd Zeitschrift"** the organ of the German Colloid Association, has published a volume in the honour of Prof. RICHARD ZSIGMONDY'S 60th birthday. This volume contains articles by the most well known specialists on the chemistry and physics of colloids. It is excellently illustrated by tables and contains a photograph of Professor ZSIGMONDY (*Jubelband der Kolloid-Zeitschrift*, Organ der *Kolloid-Gesellschaft*. Unter Mitarbeit von Freunden, Verehrern und Schulern herausgegeben von W. BACHMANN und W. OSTWALD. *Ergänzungsband zu Vol. XXXVI der Kolloid Zeitschrift*, pp. 390, figs and tables. Dresden 1925).

775. **"La Colmena".** — This periodical has been edited since January 1, 1925, by the Spanish apiculturist Sig. NARCISO J. DE LINAN Y HEREDIA, who has edited for four years a section entitled "La Colmena" (the Bee-Hive) in the "Revista Social y Agraria" and has transformed this section into a separate Review.

776. **The "Boletin de Agricultura técnica y economia",** official organ of the "*Dirección general de Agricultura y Montes*" in Spain, will have a special section for information supplied by the International Institute of Agriculture, Rome.

777. **"El Progreso agricola y Pecuario"** treats in the February 28 issue (No. 1380), of the Wheat Conference which took place at the end of February in Madrid. The importation of wheat into Spain is discussed, and the national regulations and fiscal measures.

778. **"La Vida Agricola".** — Founded some years ago, this Catalanian periodical opened last October a new series of publications.

The "Unión de Viticultores de Cataluña" has combined its two reviews "Avenc Agricole" and "Vida Agricola" into one periodical, under the title of the latter. It is a monthly publication with many illustrations and is published by FRANCISCO SANTACANA. It published articles by well knows Spanish farmers. The first number of the new series contains the following articles: by CLAUDIO OLIVERAS MASSO, director of the Enological Station of Reus: The aeration of must; J. MIQUEL Y CUSCO cooperation in production and mar-

keting and the value of floating capital in agriculture; JULIO TARIN, the farm ing outlook The review gives the legislative and administrative measures taken in Spain in regard to agriculture, and cites the Royal Decree of 1 September 1924, relative to wines and alcohol. Publishing offices of the Review: Pelayo 12 1º, 1ª Barcelona, Spain.

779. **The Missouri Year Book of Agriculture for 1924.** — The Year Book of Agriculture for 1924, issued by the Missouri State Board of Agriculture, Jefferson City, forms the November number of the *Missouri Bulletin*, Vol. XXII, No. 11, 1924. The volume consists of 487 pages of official data and facts relative to the agriculture and country life of Missouri. A good index is provided.

780. **The new Journal of The Agricultural Education Association of Great Britain,** *Agricultural Progress*, contains, in the second volume, as in the first (1924), information valuable both to research workers and farmers. The *Weekly Westminster* describes it as "a distinct advance on any agricultural publication which has previously been issued".

781. **Yearbook of the Italian Agricultural Press.** — This publication, is issued by the "Ufficio d'incoraggiamento per esperienze di concimazione" (Bureau for the encouragement of fertiliser experiments) in Milan. It contains statistical data collected from various periodicals, regarding agriculture. It states that in Italy 229 agricultural reviews are issued and distributed as follows: Abruzzi and Molise 4; Basilicata 2; Calabria [illegible]; Campagnia 9; Emilia 20; Lazio 25; Liguria 8; Lombardy 41; Marche [illegible]; Piedmont 31; Puglia 4; Sardinia 2; Sicily 18; Tuscany [illegible]; Umbria 5; Venezia Giulia 1; Venezia Tridentina 1; Veneto 17.

These periodicals may be classified in the following categories: General agriculture 146; colonial agriculture 1; agriculture, industry and commerce [illegible]; agriculture 2, beet-culture 1, agricultural chemistry 5, cooperation [illegible], olive growing and oil-extraction 2; horticulture 6; floriculture 4; plant pathology 3; medicinal and aromatic plants 1; professional reviews [illegible]; rice planting [illegible]; forestry 4; sericulture and mulberry growing [illegible]; statistics, legislation and economy 12; tobacco planting 2; vine growing 12; stockbreeding 10.

The Yearbook gives the complete list of periodicals, arranged according to provinces, with a note on the title, period of publication, name and address of editor, etc.

782. **A Pamphlet on Peruvian Guano** — The "Compañía Administradora del Guano", the the sole agent for the sale of fertilizers in Peru, last January began the publication of a periodical treating of fertilizers and the condition of the Peruvian soil. This Company arranged some years ago a special technical section with the object of advertising the use of guano. Later on a Laboratory for agricultural analysis was founded. This Laboratory was attached to the technical section and was at the service of farmers who wished to use guano, and made trials at cost price on small plots of land, after which the fertilizing of large areas could be carried out. The periodical has different sections : one on soil, fertilizers and plant chemistry, another giving information on the situation and fertilizing problem in other countries, a third section gives technical communications. The life history of the birds producing guano and the preparation of the product will be discussed. (*Boletín de la Compañía Administradora del Guano, Lima, Peru*).

Personal.

783. In the Proceedings of the Royal Society, London (Series B, Vol 97, No B 680; 1925) a biological sketch is published on the celebrated zoologist Prof. THOMAS NELSON ANNANDALE (born 1876-died 1924). Prof. ANNANDALE was a pupil of Prof. RAY LANKASTER. He was Director and Chief of the Zoological Inspectorship of India; President of the Indian Science Congress and of the Asiatic Society of Bengal. The Professor was an indefatiguable traveller, always seeking new material for comparative study of the fauna of the Asiatic lakes.

784. Prof. BERTRAND of the Pasteur Institute of Paris held a conference at Wageningen (Holland) before the National Science Association and the Chemical Society, and discussed the importance of the minimum quantity of chemical constituents and of magnesium in the biology of plants.

785. Prof. R. BIEDERMANN, founder and composer since 1880, of the well-known "Chemiker Kalender", celebrated his 80th birthday in February last.

Prof. Biedermann is connected with to the German Patent Office.

786. Dr. A. VAN BIJLERT of Nijmegen (Holland) Professor of Tropical Agriculture at the Higher School of Agriculture at Wageningen has died in his 60th year. In 1895 Dr. van Bijlert was on the staff of the State Agricultural Station (Rijkslandbouvstation). He then went to the Dutch Indies where he remained until 1903, and on his return to Holland was appointed Professor at the Wageningen School, of which he became Rector in the year 1920-21. He wrote for many reviews, especially on the subject of tropical agriculture.

787. Prof. F. CAVARA, Director of the Institute and Botanical Garden at Naples read a paper on the work of the late Prof. ANTONIO BORZÌ, the well known Director of the Botanical Garden of Palermo University and eminent phytologist and biologist. The paper was read at the Conference held in Rome on 13 January 1923 under the auspices of the Agricultural Association of Italy, and the Association has published the paper in its Proceedings (Year IV-V. No. 5, 1924). Among the numerous works of Prof. Antonio BORZÌ the most famous is the: "*Studi algologici*" at which he worked for 16 years, and which treat of chlorophyll. For this study the author was awarded the "Premio Desmazières» of the French Academy.

788. Doctor BRUNO BRUCKNER, Director of the sugar factory at Stralsund and Curator of the German Institute for the Sugar-Industry, died on February 28th 1925

789. Prof. N. H. COWDRY, botanical well known for his botanical researches on the structure of plant cells, died in January last at the age of 76.

790. Dr. ARTHUR DENDY, Professor of Zoology at King's College, London and well known for his biological works, especially investigations on sponges, died in March last at the age of 59.

791. GEORGES FROM, professor of pathology and cryptogamy at the Agricultural Institute, Paris, has been decorated Officier of the Legion of Honour.

792. In the *Proceedings of the Royal Society* of London (Series B, Vol. 97, No. B. 686 ; 1925) a memorial is published respecting W. A. HASWELL (1854-1925), Professor of Biology of Sydney University, who has written many works on in the field of Zoological research. He has also been one of the authors of the *Text-Book of Zoology*, which was published in close collaboration with the late Professor E. JEFFRY PARKER. This work has become a well known book of reference on Zoology.

Dr. Haswell was President of the Linnean Society of New South Wales and in 1891 was President of Section D. of the Australian Association for the Advancement of Science. He has taken an active part in the work of the Australian Museum and in 1916 was Editor of the Report of the Australian Antarctic Expedition.

793. THE "LEEUWENHOEK" MEDAL of the Academy of Science of Amsterdam has been awarded to Dr. F. d'HÉRELLE, the bacteriologist. Former medals had been awarded to ERENBERG (1875), COHN (1885), PASTEUR (1895), BEJRINCK (1905) and DAVID BRUCE (1915).

794. Dr. Ing. HANUS KARLIK, well known specialist in the Czecho-Slovakian sugar industry, celebrated at Prague his 75th birthday on 23 March, 1925.

795. PROFESSOR Dr. WALDEMAR VON KNIEREM celebrated at Riga on 11 May the fiftieth anniversary of his active career in agricultural research.

796. After a long career as a scientist and teacher, Prof. GUGLIELMO KOERNER died on 26 March at Milan, at the age of 86. He was for more than 50 years professor of organic chemistry at the Royal School of Agriculture, and at the R. Politechnical School at Milan. He was Director of the first Institution for many years. Prof. KOERNER was an active and honorary member of numerous scientific institutions such as the Accademia dei Lincei, Società Italiana delle Scienze ; K. Preussische Akademie der Wissenschaften, Deutschen Chemischen Gesellschaft ; Royal Society of Great-Britain ; Chemical Society of London ; he was Doctor *honoris causa* of the Universities of Cambridge, Oxford, and Giessen, and was awarded the "Davy" medal of the Royal Society of London and the "Lavoisier" medal of the Société Chimique de France, etc.

His studies on aromatic substances are widely known.

797. The "JOSEPH LEIDY" Medal of the Philadelphia Academy of Science has been awarded to Dr. HERBERT SPENCER JENNINGS, Professor of Zoology and Director of the Biological Laboratory at John Hopkins University.

798. The death is reported of Prof. ATTILIO LENTICCHIA, Director of the Royal National Institute of the Silk Industry at Como (Italy). Prof. LENTICCHIA is known for his numerous improvements in regard to silk production, and to the form, composition and structure of the silk thread. Latterly, he was chiefly occupied with the rearing of wild silkworms, principally of the *Antheraea Pernyi* variety and to the utilisation of their cocoons. Prof. LENTICCHIA took his degree in 1874 at the Higher School of Agriculture at Milan and was for 15 years Professor of Natural Science in the Cantonal Lyceum of Lugano.

799. Prof. FRANK R. LILLIE and his wife have given $[illegible] for the new Zoological Research laboratory of the University of Chicago.

800. In the Brazilian Review *Broteria* reference is made to ADOLPHE FREDERICH MOLLER who was inspector of the Botanical Garden of Coimbra University, and died in 1920 at Lisbon. He has done much work in connection with the organization of the Portuguese herbarium and wrote articles for many Reviews, especially for the *Jornal de Horticultura pratica*, the *Gazeta de Farmacia* and the *Jornal da Sociedade Pharmaceutica Lusitana* (*Broteria*. Botanical series, vol. XXII, No. II).

801. The " RUMFORD " medal has been give by the Royal Society of Great Britain to C. V. BOYS for his discoveries in connection with gas calorimetry ; the " Davy " medal has been awarded to Prof. PERKIN for his researches on the structure of natural colouring substances.

802. CARLO PRIZIBYLLA died on 27 January; since 1919 he was Director of the Institute for Potash Researchs and gave the whole of his time to the scientific problems related to the chemistry of potash, and the potash industry.

803. Prof. PAUL ROSCHER, doctor of veterinary science and Professor of anatomy and physiology of domestic animals of the Agricultural Department of the Technical School at Prague died suddenly on April 4th. This Department is situated at Tetscher-Liebweld. He was an active member of the German Stock-Breeding Association and was editor of the Yearbook for Scientific and practical Stock-breeding (*Jahrbuch für Wissenschaftliche und praktische Versuchs*). Among his personal works those on the " Cricetus frumentarius ", on the development of the various breeds of cattle in the second year of their life (in collaboration with Prof. Muller), on the construction of a stall for experimental research on animals and various articles in different periodicals have been widely read.

804. The Director of the Rothamsted Experimental Station, Harpenden, England, Sir JOHN RUSSELL, has been elected corresponding member of the " Académie des Sciences ", Paris, in the Department of Rural Economy. He succeeds Prof. WINOGRADSKY who has become a foreign member of this Academy.

805. Dr. L. R. SCHRAMM has resigned the Professorship of Botany at Cornell University, on taking up his duties as Chief Editor of the *International Biological Abstracts*.

806. Prof. RICHARD ZSIGMONDY, the great investigator on colloids, was the recepient of great honours on the occasion of his 60th birthday.

A number of well-known scientists furnished articles for the Jubilee-Publication which has been published by the *Kolloid Zeitschrift* in a handsome binding and containing a large number of original articles on physical colloid-chemistry. (See also under the heading « Journals and Reviews »).

Dott. G. A. R. BORGHESANI, *direttore responsabile*.

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CURRENT NOTICES.

NOTE. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

The Editor's notes are marked (*Ed.*); the letter *R.* indicates the references to the foregoing issues (Monthly and Quarterly) of the International Review.

ORIGINAL ARTICLES

THE PHYSIOLOGICAL VALUE OF PHOSPHORIC ACID IN SUPERPHOSPHATE AND OTHER PHOSPHATES.

The question of plant food equivalents at the present day mainly resolves itself into the problems of nitrogen and phosphorus supplies for our cultivated plants. The phosphorus problem in particular has assumed such prominence that a great number of investigators in the bio-chemistry of plants and soil have set themselves to ascertain whether the water soluble phosphoric acid of the superphosphates can be replaced by other phosphates. Attention has already been drawn to the cost of breaking down the raw phosphates by means of sulphuric acid, which amounts to hundreds of thousands of dollars every year. This exceptionally large expenditure, together with the great competition of other fertilisers, in particular basic slags, which do not require acid treatment, is causing anxiety in technical circles even in respect to a comparatively near future.

According to calculations made in 1913, about 6 600 000 tons of mineral phosphate were manufactured into 11 000 000 tons of superphosphate by means of 6 690 000 tons of sulphuric acid (*).

Of late years an effort has been made to introduce the use of phosphates, the manufacture and breaking down of which is effected either by chemical, or by biological means.

To the first group, in which the phosphates are produced by chemical means, belong the following:

I. 1. Pure calcium di-phosphate with 42.27 % of total phosphoric acid, completely soluble in PETERMANN'S solution.

(*) See INTERNATIONAL INSTITUTE OF AGRICULTURE, BUREAU OF AGRICULTURAL SCIENCE, *Production et consommation des engrais chimiques dans le monde*. 3rd ed., with maps and diagrams. Rome, 1924.

2. Pure calcium tri-phosphate containing 45.70 % total phosphoric acid, of which 17.27 % is citrate soluble.

3. Ground basic slag with 18.21 % phosphoric acid citrate soluble and 18.88 % total phosphoric acid.

4. Rhenania phosphate from the "Fors" establishment with 25.91 % total phosphoric acid, of which 25 % is soluble in citric acid, and 24.13 % citrate soluble.

5. Belgian sinter phosphate with 17.69 % total phosphatic acid, of which 14.56 % is soluble in citric acid.

6. "Reform" phosphate produced according to the process of O. Reitmair, Vienna, and manufactured by the Reform-Fertiliser Company, Schwarz & C., of Vienna. The product contains 21-22 % total phosphoric acid, of which 2-3 % is soluble in water, 3-4 % in citrate and 9-10 % in citric acid.

7. Neutral phosphate, produced by the *Montan- und Industriewerke* formerly Joh. Dav. Starck, Kasniov near Pilzen according to the process of F. Heller, Prague. The product contains 23-27 per cent. total phosphoric acid, of which 5-6 % are soluble in water, 10-12 % soluble in citrate and 16-18 % soluble in citric acid. Under the influence of carbonic acid and water, after 62 days 82-83 % of the total phosphoric acid contained in the neutral phosphate are dissolved.

8. Finely ground raw phosphate of De Haën, Seelze, containing 33.80 % total phosphoric acid.

9. Colloid phosphate of the same firm with 24.65 % total phosphoric acid.

10. Humus phosphate is produced by biological means, following the method of Julius Stoklasa. The humus phosphate contains 12-13 % phosphoric acid soluble in the soil, 20-25 % organic matter and in 1 gm. 600-800 millions of active bacteria.

***

As early as the nineties of the last century I made a number of detailed chemical and physiological studies of the different forms of phosphoric acid, soluble and insoluble in water, in order to find a basis for judging the physiological values which the various forms of phosphoric acid have for the building-up of the new plant living substance. I was also the first to isolate and analyse all water soluble forms of phosphor-

ic acid in super-phosphates and to carry out comparative experiments on their reactions in the different soils. The physical and chemical character of the ortho-phosphoric acid of the monophosphates as well as that of the di- tri- and tetraphosphates is of immense importance to an understanding of the mechanics of numerous reactions in the study of the compounds of phosphoric acid with the constituents of the soil. In my opinion this method is much more in keeping with reality than a whole series of experiments with the superphosphates, in which the phosphoric acid appears in so many various forms and in which the composition of the superphosphates has usually not been taken into account by those who made the experiments.

The water soluble part of phosphoric acid in superphosphate consists of :

I. Free-phosphoric acid.
II. Calcium monophosphate.
III. Magnesium monophosphate.
IV. Iron monophosphate.
V. Aluminium monophosphate.

The superphosphate manufactured from the Florida phosphate at present in so much demand, when broken down with sulphuric acid of 50° B. contains water soluble phosphoric acid in the following forms :

P_2O_5 soluble in water . . .	17.69 % and that :
Monophosphate of calcium .	5.60 %
Free-phosphoric acid	10.62 %
Monophosphate of magnesia	0.54 %
Monophosphate of iron . . .	0.51 %
Monophosphate of aluminium	0.42 %

Bone-dust-superphosphate, with the glue removed, manufactured from bone-dust (broken down by sulphuric acid of 60°B.) contains water-soluble phosphoric acid in the following forms :

P_2O_5 soluble in water . . .	18.60 % and that :
Monocalciumphosphate . . .	16.36 %
Free-phosphoric acid . . .	2.24 %

Usually all superphosphates manufactured from mineral phosphates by means of sulphuric acid of 50° B contain phosphoric acid

in large quantities in the form of ortho-phosphoric acid, glue-free bone-dust on the contrary, broken down by 60° B. acid mostly contains phosphoric acid in the form of monocalcium-phosphate. The bisuperphosphates mostly contain water-soluble phosphoric acid in the form of monocalcium phosphate.

The subsequent modifications of water soluble phosphoric acid in the soil under the influence of calcium carbonate and calcium bicarbonate and that of iron and aluminium compounds, present problems of considerable interest.

Phosphoric acid in the form of monophosphates in the soil shows quite a different chemical reaction from that of ortho-phosphoric acid. Supposing we employ 5 quintals of superphosphate with 20 % soluble phosphoric acid per ha. and that we reduce the latter to monocalcium phosphate, to every hectare of arable soil there is 178 kg. monocalcium phosphate. If we assume further that arable soil has a specific gravity of 1.5 and a content of 0.4 % calcium carbonate, a percentage often to be met with in our soils, then the monocalcium phosphate in 20 cm. of arable soil is in contact with 12 000 kg. calcium carbonate. Thus to one part of the mono-phosphates there always correspond 66 parts of calcium carbonate.

Under these conditions besides dicalcium phosphate, tricalcium phosphate will always form, as was the case with our experiments. From these examples it may be inferred that the phosphate-ions cannot long remain in a soluble condition in the soil. On the basis of my experiments I was able to state that this transposition of the total mass does not occur suddenly, but needs a certain time. As the water soluble forms of the phosphoric acid penetrate into the deeper layers of the arable, meadow, forest and garden soil, the water soluble phosphoric acid is of course continually transformed into insoluble forms, a fact which I have also proved by special experiments.

According to our observations carried out for many years on soils free from iron and aluminium compounds, the water soluble phosphoric acid, if present in the form of monocalcium-phosphate, is transformed in the soil into water insoluble forms and actually into tricalcium phosphate within 32-38 days. But if the phosphoric acid occurs in the form of orthophosphoric acid, the phosphoric acid in the soil is only transformed into diphosphates and triphosphates after 36-48 days.

The circulation of the calcium carbonate dissolved in water chiefly occurs in the soil in the form of $CaH_2(CO_3)_2$. As is known from numerous analysis, the soil atmosphere always contains carbon-

dioxide and sometimes in considerable quantities (0.05-1 %). One litre of distilled water saturated with carbon di-oxide dissolves 0.244 to 0.27 gm. of $CaCO_3$ (1). The more calcium carbonate there is contained in the soil, the quicker the forms of the phosphoric acid soluble in water are transformed into di- and triphosphates. From the preceding examples we see how easily the carbonic acid soluble in water may be transformed into an insoluble form, when it comes into contact with calcium carbonate in various soils and at different depths: they also afford proof that it is of some importance whether the superphosphate contains water soluble phosphoric acid in the form of monophosphates, or ortho-phosphoric acid. The di- and tricalciumphosphates and even magnesium phosphates arising from the water soluble forms of phosphoric acid are very easily re-transformed into monophosphates by the biochemical processes in the soil and re-absorbed by the root system of the cultivated plants.

Hence the remarkably favourable effect of superphosphate in building up the living substance of plants becomes fully intelligible. Besides calcium carbonate and magnesium carbonate, calcium-, magnesium aluminium-, ferro- and ferri-silicates also bring about in the soil the transformation of water soluble phosphoric acid into the insoluble form.

We will now consider the influence of the sulphates occurring in the soil, upon the phosphoric anhydride of the soil solution.

According to my experiments there are no compounds insoluble in water formed from water soluble phosphoric acid under the influence of the calcium, magnesium, and aluminium sulphate. I have called attention to the fact that aluminium phosphate with water soluble phosphoric acid does not give insoluble compounds. Ferro- and ferrisulphates however behave in quite a different way. When these come into contact with the water soluble phosphoric acid in the soil, there are always formed ferro- and ferriphosphates, insoluble in water.

From this it may be seen that in the presence of ferro- and ferrisulphate, ortho-phosphoric acid and monocalcium-phosphate, transform themselves into insoluble ferriphosphates, that is to say that soluble phosphoric acid is transformed into the insoluble form.

(1) According to my investigations, per 1 hectare of soil and in a 30 cm. layer at a temperature of 13-17 ° C. the following quantities of carbon dioxide are formed in 200 days:

Barren soil.	120 q.
Soil of average quality	240 q.
Very fertile soil	480 q

The ferro- and ferrisulphates in the soil must be considered as injurious salts, because they cause an immediate transformation of the soluble compounds of the phosphoric acid into insoluble forms.

We have observed interesting phenomena which show that the free ortho-phosphoric acid is transformed with the ferro- and ferri-compounds into insoluble ferro- and ferri-phosphates, which, as having a very small excess of ortho-phosphoric acid, are much more easily reduced to monophosphates than the compounds arising from the monophosphates.

On soils richer in ferro- and ferri-compounds (ferro- and ferri-sulphates occur but seldom) such superphosphates ought to be employed in which the phosphoric acid is mostly, or exclusively, present in the form of free-phosphoric acid. The whole metamorphosis of the soluble phosphoric acid takes place in the upper layers of the arable land. In soils poor in chalk this fixation proceeds much more slowly, in those rich in chalk more quickly. Deeper than 30 cm. there only penetrates a small proportion of the phosphoric acid which has been applied to the surface. The soluble phosphoric acid in the soil does not long remain as free acid, but is transformed into insoluble compounds.

The more intensively the biochemical processes in the soil take place, the quicker the compounds not soluble in water are transformed into soluble forms. The breaking down of the newly-formed insoluble phosphates, is owing to the activity of the different groups of bacteria, of different species, and depends upon the nature of the micro-organisms and on the metabolism of their energy and their substance and also upon the quantity and disintegrating power of the organic matter in the soil. It is most of all the intensity of the processes of assimilation of the bacteria groups by which a great influence is exercised on the metamorphosis of the phosphates not soluble in water.

Our experiments have shown that very large quantities of carbon dioxide and organic acids are produced during growth in those layers of the soil in which the plant is rooted. These immense quantities of carbon dioxide and organic acid are formed by the very important vital function of all micro-organisms, that is to say by anaerobic and aerobic respiration (1).

(1) By diffusion the following quantities of carbon dioxide were given off per one hectare of alluvial soil at 14-17°C. in 200 days:

Infertile soil	36-58 q.
Soil of average quality	66-80 q.
Fertile soil	90-150 q.

In employing phosphoric acid soluble in water we must always take into account the condition of the soil. *On loamy, clayey and limy soil, a superphosphate must always be employed exclusively in which the phosphoric acid is exclusively contained in the form of free-phosphoric acid. On the contrary, on soils rich in organic matter we must make use of a superphosphate in which the phosphoric acid occurs in the form of monocalcium phosphate. If the phosphoric acid is employed in the right way and at the right time and in an adequate quantity and mixture, it may be stated that in all pot and field experiments the water soluble form of phosphoric acid always has the greatest effect.*

The good results of superphosphate do not depend on its containing phosphoric acid in a form soluble in water, but on another circumstance, *i. e.* on the facility the method of applying in a watery form offers to quick and equal distribution.

General interest attaches to the question as to which insoluble form is taken by the soluble phosphoric acid in the soil and what value is represented by the so-called soil-soluble phosphoric acid, so far as it is combined in the soil with calcium, magnesium, iron and aluminium.

The physiological value represented by the dicalcium-phosphate and dimagnesium phosphate, tricalcium and trimagnesium phosphate, ditrialuminium and ditriferriphosphate formed in the soil from the water soluble phosphoric acid, is a problem of special interest, as these are retrograde forms derived from water soluble phosphoric acid.

The experiments on plants carried out within the past two years have as a matter of fact shown us that the form in which the phosphoric acid is contain ed inthe superphosphate is not an indifferent matter. We ascertained that in the sandy soil the free phosphoric acid gave undoubtedly better results than the monocalcium phosphate. We also found the same physiological effect in a loam soil. In humus soil, on the contrary, the monocalcium phosphate gave a better result than the free orthophosphoric acid. The phosphoric acid in the forms of tetracalcium phosphate (basic slags) was not utilised as was the phosphoric acid soluble in water. Especially in the loamy

and the calcareous soil the effect was relatively small. In humus and sandy soil the favourable effect of the tetracalcium-phosphate (basic slag) was very noticeable, but at the same time fell much below the effect produced by the forms of phosphoric acid soluble in water. The hydrogenion concentration of the soil has a considerable influence (1).

If a careful examination is made of the experiments with spring oats carried out over two years, as shown in Table I, expressed in averages, it is found that water soluble phosphoric acid in the form of monocalcium phosphate and ortho-phosphoric acid have been the most effective in forming new plant-substance.

By means of analysis of the harvested dry matter, the conclusion has been reached that it was from these water soluble forms that the phosphate ion was assimilated from the greatest energy. Next to the water soluble forms of phosphoric acid the dicalcium phosphate has given good results.

TABLE I. — *Experiments with spring wheat.*

Kind of soil	Matière noire reckoned on dry matter	Monocalcium phosphate		Orthophosphoric acid	
	Percent	1.25 gm. P_2O_5		1.25 gm. P_2O_5	
		Grain	Straw and chaff	Grain	Base fertiliser
Humus soil	16.09	32.08	58.7	25.8	58.9
Lime soil	6.98	21.7	42.[illegible]	2[illegible].6	[illegible]
Loam soil	2.58	32.[illegible]	68.9	36.4	7[illegible].8
Sandy soil	0.58	24.3	57.9	35.2	70.[illegible]

(1) In soil of an acidity of PH = 4-6 neutral phosphate and basic slag can be applied successfully. On soils on which the acidity rises to P_H = [illegible] finely ground rock phosphate, containing no fluorine, has also a good effect. Certain moorland and meadow soils are of this type.

Kind of soil	Tetracalcium phosphate 1.25 gm. P_2O_5		Tricalcium phosphate 1.25 gm. P_2O_5		Dicalcium phosphate 1.25 gm. P_2O_5		Base fertiliser	
	Grain	Straw and chaff	Grain	Straw and chaff	Grain	Straw and chaff	Grain	Straw and chaff
Humus soil	25.0	61.3	16.7	32.9	25.2	56.7	12.7	25.2
Lime soil	16.75	39.9	12.4	26.4	18.3	38.9	11.2	22.7
Loam soil	20.6	50.4	15.3	30.2	21.7	44.5	12.6	26.2
Sandy soil	21.8	52.4	16.2	40.7	20.8	46.7	10.8	24.3

When I was working at the chemical manufactory of Pecek, I had the opportunity of making all these compounds of phosphoric acid in larger quantities, so that I could carry out experiments on plots having an area of 1 are for several years. The experiments were made on a good loam soil which contained 1.72 % carbon in the dry matter of the fine earth. The soil was poor in calcium carbonate, there being scarcely 0.135 %. The experiments were carried out with sugar-beet and wheat. In the case of the sugar-beet I employed as base fertiliser 80 kg. nitrogen per hectare in the form of sodium nitrate and 100 kg. potash in the form of potassium chloride.

With the sugar-beet the phosphoric acid was reckoned at 50 kg. per hectare, and applied in the form of different phosphates.

For the plant experiments with wheat 60 kg. of nitrogen were employed in the form of sodium nitrate and 60 kg. potash in the form of potassium chloride. Phosphoric acid was given in different forms, 40 kg. per hectare.

The experiments were carried out on loam soil

The results of the plant experiments with sugar beets will be considered first.

After three years, average results for sugar, in kg. per ha. were ascertained.

The experiments were carried on 1 are plots. Every experiment with the single forms of phosphoric acid, as well as with the base fertiliser without phosphoric acid, always took place on

3 plots, so that the field for the experiments was divided into 27 lots.

	Sugar reckoned as kg per ha.
Base fertiliser without phosphoric acid	2 905
Free-phosphoric acid	5 896
Monocalcium-phosphate	5 740
Dicalcium-phosphate	4 985
Tricalcium-phosphate	4 906
Monodialuminium-phosphate	5 693
Monodiferri-phosphate	5 587
Ditriferri-phosphate	4 676
Florida-phosphate	3 085

The results obtained with wheat are also very interesting. The crop harvested per hectare was estimated as follows (in quintals):

Base fertiliser without phosphoric acid	14.38
Free-phosphoric acid	30.94
Monocalcium-phosphate	25.85
Dicalcium-phosphate	23.06
Tricalcium-phosphate	20.73
Monodialuminium-phosphate	24.78
Monodiferri-phosphate	23.05
Ditriferri-phosphate	19.61
Florida-phosphate	16.19

These figures illustrate very clearly the value of the results from water soluble phosphoric acid in comparison with the retrograde phosphoric acid not soluble in water, which changes into different forms in the soil. The compounds of the retrograde phosphoric acid which, chiefly form in the soil are: dicalcium-, tricalcium-, monodialuminium, monodiferri, and ditriferri-phosphate. It should be emphasised that all these phosphates were freshly prepared, and correspond to the the vicissitudes through which the water-soluble phosphoric acid passes in the soil. Consequently the effect was noticeable, principally in comparison with the phosphoric acid found in mineral phosphates, such as, *e. g.* Florida phosphate.

It is also quite clear that the dicalcium, dimagnesium, monodialuminium and mono-

diferriphosphates are much more quickly transformed into monophosphates than the triphosphates. Mineral Florida phosphate has shown a decidedly poor effect in the formation of the living substance of sugar beets as well as of wheat.

As early as 1898 finely ground phosphate was recommended by GUSTAV MARCK (2) in place of superphosphate for dressings. Further experiments were undertaken by PRICAISCHNIKOW, KUIERIM, DAFERT, and MIKLAUS (3) to establish whether or not the finely ground mineral phosphates could be used as fertilisers.

The writer has been occupied upon this problem for over 30 years and has arrived at the conclusion that for the physiological utilisation of the phosphoric acids the fluorine and carbonate content of the phosphates applied to the soil is of great importance. Through the action of the carbon dioxide and the organic salts given off by the bacteria, as well as through that of the carbon dioxide evolved by the root system of plants, and that of all the forms of humous acids which are present in the soil and are continually being formed from organic substances, the phosphates which are free from fluorine are much more energetically transformed into monophosphates than those phosphates which contain fluorine. The effect of the organic acids depends in this case on the fact that in consequence of their capacity for OH-ions and thereby for forming bases, they reinforce the otherwise slight hydrolytic splitting of the di- and triphosphates. It is established that the absorption of the phosphoric acids through the root system of the cultivated plants goes on much more energetically if the phosphates are without fluorine or are poor in fluorine. No phosphate containing an abundance of fluorine, if incorporated in the soil in a finely ground state, is fully utilised within the year. The physiological value of phosphoric acid in the mineral phosphates as in the soil is in the first instance dependent on fluorine content. Between fluorine and phosphorus there are certain connections. The plant experiments with lupins provide classic proof in this respect. The yield of the yellow and blue lupins was about 70 to 130% higher on application of mineral phosphates which merely contained 0.1 to 0.3 % fluorine, as against the mineral phosphates which contained 3 to 4 % fluorine, as for example Florida and Gafsa phosphate.

The inference from my experiments is clear that by the re-

moval of the fluorides and carbonates from the mineral phosphates a complete metamorphosis in the constitution of the phosphatic substance is effected.

The following facts are undoubtedly of great interest: if basic slag is smelted with calcium fluoride, so that the phosphatic mass contains 5 to 6 % fluorine, the phosphoric acid of this mass when finely grounds is only with great difficulty soluble in citric acid. From the action of carbon di-oxide on phosphate mixed with water it was shown that the more fluorine was contained in the phosphates, the less readily was phosphoric acid transformed into monophosphate.

By the removal of the carbonate and fluoride, the calcium and magnesium phosphate become easily attacked by the carbon dioxide given off by the root system of the plant and the carbon dioxide and the organic acids given off by the bacteria, and brought into an assimilable condition.

These facts have been established by REITMAIR (4) in his observations on the effect of the new Reformphosphate. By the quantities of sulphuric acid which he applied for the destruction of the carbonate contained in raw phosphate, REITMAIR has succeeded in effecting a remarkable rise in the degree of dispersion of the particles of a phosphate and a displacement of the mineral structure. The plant experiments with the Reform phosphate which REITMAIR has instituted, show with great clearness the immense differences in effect between the soft and the hard phosphates, as well as the coarse and the fine phosphates, and moreover throughout a remarkable result obtained from the new Reform phosphates, which surpasses the former type in its raw material, and approaches the effect of superphosphate.

As regards the removal of the fluoride from the mineral phosphates FRITZ HELLER has carried out investigations on a large scale in Kasniov, in the works of Joh. Dav. STARCK, Prague, and has also had his process patented. Phosphate from which the fluorine and the carbonate have been removed by sulphuric acid is put on the market by the firm as ***neutral phosphate.***

The writer has obtained some excellent results in plant experiments carried out on different crops with neutral phosphate. If it is proposed to break down the mineral phosphates which are rich in fluorine, *e. g.* apatite, Florida- or Gafsa-phosphate, etc., it is observed that within two months 6 % at most of the total phosphoric acid

in the water is dissolved in the current of carbon dioxide which is passed through the water, where are found the raw phosphates in fine particles. If the fluorine and the carbonate have been removed from the apatite, the Florida- and Gafsa-phosphates, from 82 to 88 % of the total phosphoric acid of the phosphate is dissolved within two months in the water containing a continuous supply of carbon dioxide in solution.

The plant experiments carried out in the greenhouse as well as on the experimental plots were very successful, and the conclusion was reached that the neutral phosphate was a phosphatic fertilizer of great importance and future.

The results are given below of the plant experiments carried out in sandy, loam and humus soils and in unglazed cylindrical containers made of clay. The sandy soil contained 0.52 % calcium carbonate, 2.84 % iron oxide and 1.65 % organic substances. The loam contained 1.8 % calcium carbonate, 2.73 % iron oxide and 4.2 % organic substances. The humus soil contained merely traces of calcium carbonate, 3.95 % iron oxide and 12.8 % organic substances.

The P_H of the soils was found to be: sandy soil, 6.83, loam, 7.05, humus, 5.88.

In sandy soil the sprouted seeds weighed 18 mg., loam soil 58 mg. and humus 23 mg. per 1 gm. of soil.

The respiration intensity was studied in the different soils, that is to say for 1 kg. of soil containing 25 % water, at a temperature of 20°C. and through which was passed 20 litres of air free from carbon dioxide and bacteriologically pure, in 24 hours. The experiment lasted 25 days, and showed:

In sandy soil an intensity of 28.2 mg.
» loam » » » » 36.4 »
» humus » » » » 32.7 »

For all pot cultures the base fertiliser applied was a mixture of 1.7 gm. sodium nitrate and 2.3 gm. potash in the form of potassium chloride.

For the first series of experiments only nitrogen and potash were used.

For the other series phosphorus was added to the base fertiliser and in the following forms: I. Gafsaphosphate, II. Monocalcium-phosphate, III. Orthophosphoric acid, IV. Basic slag and finally, V. Neutral phosphate.

To each pot culture was applied 2.2 gm. P_2O_5. The seed used for the purpose was Bohemian barley.

Experiments with Barley.

TABLE II. — Sandy Soil:
Average yield in dry matter from 10 pot cultures:

	Grain in gm.	Straw, etc., in gm.
Without phosphoric acid . . .	68.3	154.2
Gafsa phosphate	75.3	158.7
Monocalcium phosphate	150.7	265.9
Free-phosphoric acid	268.5	284.3
Basic slag	132.3	250.7
Neutral phosphate made from Gafsa phosphate	156	294.0

Loam: *Average yield in dry substance from 10 pot cultures:*

	Grain in gm.	Straw, etc., in gm.
Without phosphoric acid . . .	88.3	180.5
Gafsa phosphate	105.7	201.9
Monocalcium phosphate . . .	179.3	308.2
Free-phosphoric acid	198.5	329.4
Basic slag	134.0	221.7
Neutral phosphate made from Gafsa phosphate	178.8	325.9

Humus Soil: *Average yield in dry substance from 10 pot cultures:*

	Grain in gm.	Straw, etc., in gm.
Without phosphoric acid . . .	62.7	125.8
Gafsa phosphate	114.0	169.7
Monocalcium phosphate . . .	192.3	342.0
Free-phosphoric acid	181.8	327.1
Basic slag	154.7	298.8
Neutral phosphate made from Gafsa phosphate	198.6	346.5

A thorough inspection of the data obtained from the three years experiments with barley reveals the fact that the water soluble forms

of phosphoric acid have most effect in sandy soil or loam. It is in fact clear that free phosphoric acid produces the highest yield in sandy soil and loam, though its physiological effect is less in humus soil.

This phenomenon is of considerable importance, having regard to the fact that in sandy soils as well as in loam and humus soils, the finely ground raw and Gafsa-phosphate produced only a very slight physiological effect. On the other hand the neutral phosphate produced by removal of the fluorine and carbonate not only surpasses raw phosphate in its effect, but it still further outdistances basic slag.

These results of three years' experiments with barley are very instructive and confirm our observations made in connection with the study of the influence of bacteria on the solubility of phosphate. It was found that phosphates after removal of the fluorine are so much transformed (7) that under the influence of bacterial secretions the water-insoluble phosphates very easily change into the water soluble forms. During the changes that take place in the water-insoluble forms of the neutral phosphate, hydrolysis takes place very rapidly. The energy of the decomposition and of the transformation into monophosphates is set up in the first place by the bacteria which assimilate nitrogen in its pure form and then by the ammonia bacteria, but mainly by the bacteria belonging to the root area in the barley.

The root system of barley (8) has a remarkably sensitive reaction to the different forms of phosphoric acid in the soil. Not only the carbon dioxide given off by the root system of the plants but also the bacteria of the root areas have a marked capacity for breaking down the water insoluble forms of phosphoric acid. If the phosphates contain much calcium carbonate, the breaking down process goes on very slowly.

Both the accurate tests for growth and the numerous experiments carried out in the plots during two years with the different cultivated plants and especially with wheat, rye, potatoes, sugar beet and mangolds furnish evidence that superphosphate in the physiological value of its phosphoric acid surpasses that of all other modern phosphates.

Some experiments may be quoted here made by the writer with sugar beet, grown in a loam containing 1.8 % calcium carbonate.

Experiments with Sugar Beet.

The results from the separate experimental plots have been reckoned per hectare.

62 kg. of nitrogen in the form of Chile nitrate and 80 kg. potash in the form of potassium chloride were applied as base fertiliser. On some plots in addition to the base fertiliser, 52.5 kg. phosphoric acid was applied in the form of superophosphate and neutral phosphate. The results are as follows:

Yield of beets per hectare:

Unmanured, 238 quintals with a sugar content of 16.58;

Base fertiliser, 272 quintals with a sugar content of 17.37;

Base fertiliser, with superphosphate, 366 quintals with a sugar content of 18.8;

Base fertiliser with neutral phosphate 360, quintals with a sugar content of 18.5.

These figures show clearly that the superphosphate has had a very decided effect on the yield in beets and has greatly assisted the formation of sugar, and also that the neutral phosphate comes very close to it in physiological effect.

The conviction has been reached on the basis of many years of experience in the study of the physiological effect of the phosphoric acid in the different phosphates, *that, of all the phosphates which contain phosphoric acid in a water insoluble form, the phosphoric acid in neutral phosphate is the form which most effectively increases production of new living plant substance. In consequence, neutral phosphate can satisfactorily replace basic slag as a plant food material*, especially for leguminous crops and for the tillage of meadow and forest land.

The physiological results obtained by neutral phosphate show clearly that the application of citric acid affords no trustworthy criterion for ascertaining the results of phosphoric acid in the different phosphates. Citric acid does not belong so far as is known to the type of acids which are usually found in the different soils. It was selected by the writer in the first place because it resembled the acids of the cell sap. Further experiment has shown that the P_H content of the cell sap in the root system varies from 6 to 7. The only acid which forms when sufficient oxygen is present, and is given off by the respiratory process of the root system of plants, is carbon dioxide.

Carbon dioxide in solution is the best agent for giving some partial indication of the capacity for absorption of the phosphate ion of the different phosphates, through the root system of the plants.

In experiments on the physiological value of the phosphoric acid in the different phosphates, the choice of the plants to be used in the experiments is of great importance.

It has been known for some time that the phosphate-ion is not absorbed from the soil in the same way and in the same time by the root systems of the different cultivated plants. With a view to obtaining reliable data, plant experiments have been undertaken on our experiment plots and in particular with *Triticum vulgare, Hordeum vulgare, Avena sativa, Pisum sativum, Vicia Faba, Lupinus luteus, Trifolium pratense, Medicago sativa, Solanum tuberosum, Beta vulgaris.* The soil was of uniform fertility and remained unmanured. The results were calculated on a hectare of ground in each case.

The nitrogen- phosphoric-acid and potash content of the whole plant (aerial and subterranean parts alike) was determined in the first instance after 60 days growth and secondly at the end of the vegetation cycle. The average results of three years observations are the following:

Phosphoric acid content of the whole plant after 60 days growth: —

Hordeum vulgare	26.84 kg.
Triticum vulgare	29.93 »
Avena sativa	32.08 »
Beta vulgaris	34.27 »
Solanum tuberosum	30.58 »
Trifolium pratense	20.12 »
Medicago sativa	21.84 »
Lupinus luteus	18.74 »
Vicia Faba	23.64 »
Pisum sativum	18.16 »

Phosphoric acid content of the whole plant at the end of the vegetation cycle.

Hordeum vulgare	42.58 kg.
Triticum vulgare	46.27 »
Avena sativa	38.54 »
Beta vulgaris	51.84 »
Solanum tuberosum	50.06 »
Trifolium pratense.	58.73 »
Medicago sativa	64.89 »
Lupinus luteus	40.55 »
Vicia Faba	71.46 »
Pisum sativum	45.43 »

The phosphoric acid content of the whole plant amounted accordingly, after 60 days' growth, expressed in % of the total phosphoric acid to:

Hordeum vulgare	63.03 %
Triticum vulgare	64.68 %
Avena sativa	82.23 %
Beta vulgaris	66.11 %
Solanum tuberosum	61.08 %
Trifolium pratense.	34.25 %
Medicago sativa	33.65 %
Lupinus luteus	46.21 %
Vicia Faba.	33.08 %
Pisum sativum	39.97 %

From this survey it is evident that the cared crops, i. e. Hordeum vulgare *and* Triticum vulgare *re-absorb* 63-64 % *of the total phosphoric acid from the soil within* 60 *days, while* Avena sativa *re-absorbs* 83 % *of the total phosphoric acid in* 60 *days.* Beta vulgaris *and* Solanum tuberosum *re-absorbed in* 60 *days, similarly,* 61 *to* 66 % *of the*

total phosphoric acid. The leguminous plants form an exception as in their case the quantity of phosphoric acid re-absorbed in 60 days is not so great, amounting to 33-46 % of the total phosphoric acid. These results harmonize completely with farming practice, as we note that the leguminous plants possess the greatest capacity for utilising rock phosphates which contain phosphoric acid in a highly insoluble form, because at the commencement of their growth they do not require so much phosphoric acid for building up the living plant structure.

For the appraising of the utilization of phosphoric acid from the different phosphates, the plants with which experiments are made are of great importance. In any case the cereals have to find phosphoric acid in the soil in an easily assimilable form, which is also true of *Beta vulgaris* and *Solanum tuberosum*. The leguminous plants can on the contrary, as has been already mentioned, make use of highly insoluble phosphates, as through their biochemical activity in the soil the triphosphates are gradually transformed into monophosphates.

SUMMARY.

Experiments carried on over a number of years in manuring with the different forms of phosphoric acid have led to the following results :

(1) It is by no means a matter of indifference in which form the water soluble phosphoric acid appears in the superphosphate. The free-phosphoric acid has decidedly a better effect than the monocalcium phosphate when used on sandy loam and chalk soils; on the other hand, the water soluble form of the acid as monocalcium phosphate stands the test better on humus soil. It follows from this that the superphosphate factories should manufacture for use of sandy soil, loam and chalk soils, a superphosphate in which the phosphoric acid is chiefly available as free-phosphoric acid ; this is very easily broken down by an excess of sulphuric acid.

(2) The water-insoluble phosphoric acid found in any form in the different types of phosphates now on the market has less physiological value than the water-soluble forms in superphosphate.

(3) The water-soluble phosphoric acid so acts in the soil that the seedlings find at once within the area tapped by their roots the phosphoric acid in assimilable form. This is of great

biological importance, because the phosphorus can be utilized in the early stages of plant development for the building up of the new cell substance.

(4) Phosphorus is not only required for the formation of the cytoplasm and caryoplasm, but for the building up of chlorophyll in the cells containing chlorophyll. (1)

(5) Phosphorus, together with potassium and magnesium, takes a very important, part in the processes of photosynthesis, which are closely connected with the building up of chlorophyll in the plant cells.

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(1) My assistants URBENSKY and BORISOV obtained from their investigations with approximately 1400 soils from the Czecho-slovakian Republic, the following results. The electrometric method was employed, as the colorimetric method gives unreliable results.

Active acidity:

PH = 4-5	1.68 %	in the soil
PH = 5-6	[illegible]	» » »
PH = 6-7	[illegible]	» » »
PH = [illegible]	[illegible]	» » »
PH above 8	3.36	» » »

Exchangeable acidity:

PH = 3-4	4.24	in the soil
PH = [illegible]	[illegible]	» » »
PH = [illegible]	[illegible]	» » »
PH = [illegible]	[illegible]	» » »
PH = [illegible]	[illegible]	» » »
PH above 8	0.85	» » »

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THE CHILEAN NITRATE INDUSTRY.

Fig. 143. — Map of nitrate region.

Nature has collected, it might be thought for contrast, large quantities of a very valuable substance in one of the most arid and inhospitable regions of the world. This substance can restore to the soil lost fertility, and can assist humanity by increasing crop yields. By the aid of chemistry many other materials of the greatest utility can be derived from this product, e. g, explosives, which reduce the cost of sextracting metals and combustible materials, from the soil, and which are of great assistance in making tunnels and constructing bridges; in the manufacture of artificial dyes of varied and permanent colours, never before obtained; in the making of compounds employed in the alleviation of human pain.

In the northern part of Chile (19° to 26° South latitude, and 70° West of Greenwich) (fig. 143) there are for a distance of about 50 kilometres, beds containing great masses of useful materials, such as nitrate of soda or Chilean nitrate, common salt, sulphate of soda, borax, sulphate of aluminium, etc. One cannot fail to receive a very deep impression

PLATE LXIV.

FIG. [illegible]. — View of the country.

FIG. 149. — Garden and management offices in the middle of the Pampas.

FIG. 150. — The river Loa.

FIG. 151. — Channel of the river Loa and dam of the Nitrate Company of Tocopilla

FIG. 152. — Vegetation on a spur of the Cordillera de los Andes.

FIG. [illegible] — View of a "[illegible]" in nitrate zone.

FIG. [illegible] — View of a [illegible]

from this region, situated between two precipitous mountain ranges, far from the coast, completely deprived of vegetation, water, combustible materials, of everything that is necessary to human life. A very wide, lonely, silent country, burnt up by the tropical sun (fig. 144, Plate LXIV), the elements consuming, little by little, the rugged outlines of the mountains; at noon sultry heat, clear and cold nights, never ceasing winds. If to-day you travel by railway or motor-car over the whole Pampas, if after the day's work you rest in the offices of the Nitrate Company (fig. 145, Plate LXV), with all their modern comfort, you must perforce think of the enterprize, perseverance and courage of the first discoverers of the nitrate pampas and of the capital required to create and develop such an industry.

It has been necessary: to organize life where nature was adverse, to create towns, villages, harbours, roads and railways; to find water at a distance of hundreds of miles in the Andean Cordilleras, to import from other parts of the world the combustible materials necessary for the work, the materials for building, food for people and forage for the live stock.

The Chilean nitrate industry is also economically interesting. The output of sodium nitrate (fig. 146) has reached in the last twenty years, an average of 2.5 million metrical tons annually, containing about 400 thousand tons of pure nitrogen with a value of 300 million Chilean gold pesos; the greatest production being in 1916 with 3 million tons. Since January 1830 to January of the present year the exportation has been 70 millions tons containing about 11 millions tons of nitrogen. Considering that the increase in the commercial price of nitrogen, like that of other products, is five times the former rate, it can be said that in the above period the Chilean nitrate industry has contributed about 42 *thousand million Chilean gold pesos* to the world's wealth.

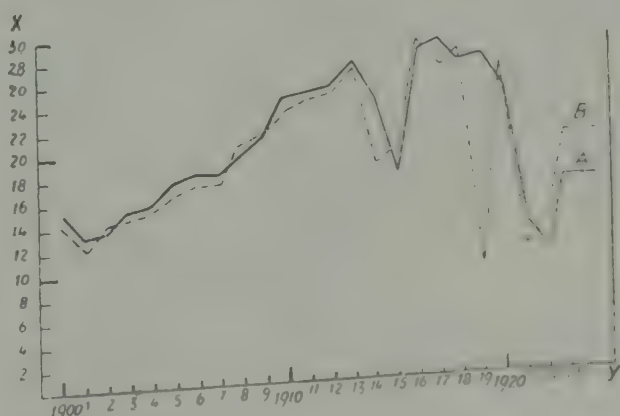

FIG. 146. — Production and exportation of Chilean nitrate.

The above industry has also produced (January 1880-January 1925) 17 500 tons of iodine with a commercial value of about 300 million gold pesos.

The exportation of another sub-product, perchlorate of potash, was, during the last 10 years, a million kg.

The production of the nitrogen industry is now 4454 thousand tons annually, divided as follows :

Chilean producers	68 %
English producers	23 %
Yugo-slavonian producers	2 %
North American, German and French producers.	7 %

The nitrate industry pays to the Chilean exchequer, besides other contributions, an exportation tax of 33.38 Chilean gold pesos for each ton of nitrate and 1.27 gold pesos for a hundred grams of iodine. From the day in which those taxes were established, that is from the first of January 1880, to the first of January 1924, the exchequer has received : from taxes on nitrate 2 076 416 000 Chilean gold pesos, from taxes on iodine 22 026 000 Chilean gold pesos.

The value of nitrate land sold by the State for the extraction of nitrate amounts to more than 50 000 000 Chilean gold pesos.

In the nitrate region are about 150 establishments connected with the industry, known as *oficinas salitreras* ; the nitrate lands, the machinery and implements are worth more than 500 million gold pesos. This sum is greatly increased by the value of railways, water installations, warehouses and accommodation at the harbours, telephones, etc.

The nitrate industry employs a great deal of labour ; 50 000 persons are engaged in the work of extracting and elaborating the nitrate, and as many are employed in the auxiliary work. It may be said that the 400 000 inhabitants of the nitrate region get an immediate or indirect gain from the above industry. The comfort and the prosperity of their life gives them compensation for an occupation carried out in an arid, burnt up region ; the industry makes this area the most important part of the country.

The industry requires annually :

250 000 tons of coal,
750 000 " " petroleum,
50 000 " " blasting powder

and a great deal of dynamite and thousands of tons of iron and steel.

The following are required annually for food :

15 000 head of cattle
15 000 tons of flour
10 000 " " potatoes
3 000 " " farinaceous products.

To feed the live-stock of the region 20 000 tons of corn and 30 000 tons of forage are imported.

At the present time there is a great demand for chemical products, of which nitrogen is very important. The requirement for nitrogen increases each year at a ratio greater than that of production, and in consequence there is a deficiency that it is almost impossible to meet.

The demand for nitrogenous products to-day, is such that it would not be sufficient to return to the soil merely the amount of nitrogen removed in the form of crops. Experience has shown that, to reduce the cost of human food, the amount of nitrogen applied to the soil must be notably increased, to the extent of double or triple the highest applications now given.

This highest application has been reached by Belgium with 76 kg. of nitrogen per hectare-year of cultivated soil. In spite of her attempts, Germany has not attained 65 kg per hectare-year. But these figures will probably increase to a marked extent in every country, owing to propaganda on this subject.

Half a million tons of pure nitrogen has been used during the last ten years ; during the War the quantity consumed was one million three hundred thousand tons ; only half this amount was required after the Armistice. We are now, slowly but surely, reaching a consumption, of a million tons.

Of the nitrogen consumed throughout the world, Chilean nitrate

always supplied a very important part (fig. 147). This exceeded 50 % until 1914; afterwards this percentage diminished because of the synthetic nitrogen industry and the disturbances in the trade of the world.

In 1923 the following amount of nitrogenous products were used :—

Chilian nitrate	305	thousand tons,	32.2 %	of total
Sulphate of ammonium from coal	232	" "	24.5 %	"
Synthetic ammonia . . .	250	" "	26.4 %	"
Cyanamide.	141	" "	14.9 %	"
Nitrate of calcium . . .	19	" "	2 %	"

Notwithstanding the changed conditions mentioned above, there are many reasons why the Chilean nitrate industry should regain its former position.

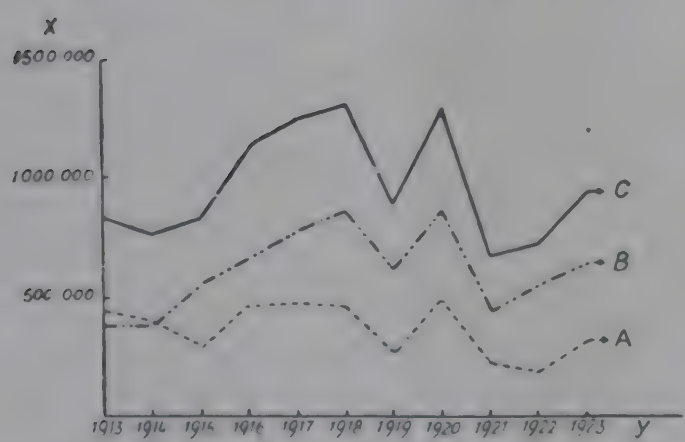

FIG. 147. — Production of nitrogenous compounds in thousands of tons of nitrogen.

A) Nitrogen as nitrate of soda.
B) Synthetic nitrogen and its products.
C) Total nitrogen for the world.

(i) Enormous beds ensure a maximum production of 3 millions tons during several centuries;

(ii) The cost of production of nitrate may be reduced owing to improved methods of extraction;

(iii) The export taxes may be altered or lowered.

Until 1914 the nitrate industry maintained its leading position, producing the maximum and selling advantageously; the price of nitrate of soda fixed the price of nitrogen all over the world, but the subsequent changes in the nitrogen industry altered everything and brought about the foundation of a society, the *Asociacion de productores de salitre* that has methodically organized the industry, controlling the sales, advertising and improving the position of the working class, in order to avoid strikes and the emigration of workmen.

At the same time the working methods have been improved; some improvements, introduced during the last ten years, allow a better use of the raw material; new processes, to be introduced without delay, have been discovered and tried. That is the part of the nitrate technique in which chemists are mostly interested and that is especially considered in the present article.

The nitrate lands of Chile extend about 30 km. West and 120 km. East from the meridian 70° West of Greenwich, the distance between the north and south limits being about 630 km. The region can be divided into four parallel, perfectly defined zones (figs. 148 and 149),

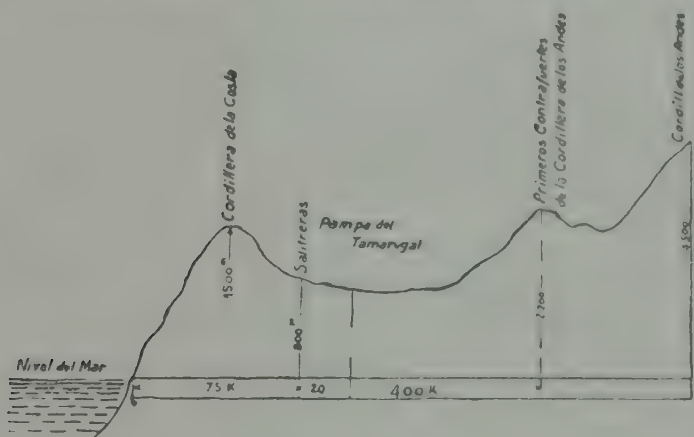

FIG. 148. — Section of the nitrate area in the Tarapaca zone.

the *Cordillera de los Andes* and the Andean uplands. The Cordillera that is parallel to the coast is a bare and precipitous barrier, with

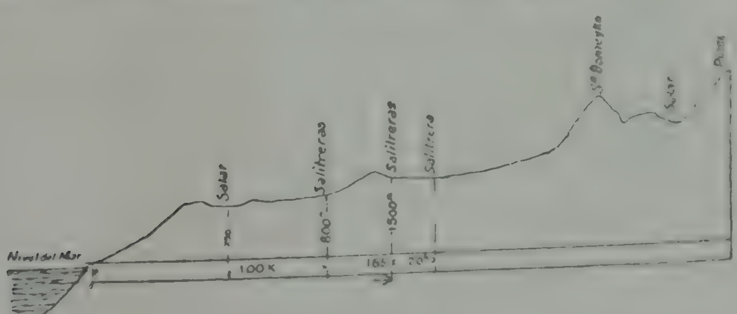

FIG. 149. — Section of the nitrate area in the Antogafasta zone.

narrow areas, higher and vertically cut on the northern part, destitute of vegetation, containing in the highest parts small deposits of common salt, chloride of potash and nitrate of soda.

This barrier is divided into four parts by deep ravines leading to the interior valley (figs, 150-151, PlateLXV); the Tiviliche ravine (Pisagua), the bed of the river Loa, the Blanca (Antofagasta) ravine and the Taltal ravine. This Cordillera has an average breadth of 60 km. and an average elevation of 1000 to 1200 m., attaining in some points 2000 m. Towards the interior of the country the slopes are easy, forming round, small hills, as far as the upland longitudinal valley. This forms the second zone, from north to south, bending somewhat towards the east in Antofagasta and presenting a succession of valleys in Taltal, in the southern part of the nitrate land, with a very variable breadth of 20 to 100 km. The third zone is formed by the buttresses of the Cordillera de los Andes, comprising fertile valleys with sufficient water and vegetation (fig. 152, Plate LXV), and small villages, real oases in the desert. Then are found the Cordillera de los Andes with summits of more than 5000 m., with deposits of sulphur, borax, carbonate of soda, common salt, etc., with perpetual snow that produces small streams that disappear in the valley, excepting the one which becomes the river Loa and after a long winding course flows into the sea.

The nitrate deposits are situated on the internal eastern slope of the Cordillera de la Costa at the same height as the longitudinal valley, forming a range of hills which disappear at a greater elevation. The deposits follow the gentle slopes of the Cordillera de la Costa excepting the Taltal region, in the southern part of which they are found on the hill summits.

The nitrate of soda is mixed with other salts and th insolublewi substances, forming a conglomeration which assumes various forms Small masses of saline materials, mixed with nitrate are found overlying the decomposed porphyry of the Cordillera de la Costa. These unimportant deposits belong to the oldest formations ; the more interesting deposits, those that are industrially exploited, are stratified. At a certain depth there have also been found deposits (figs. 153-154, and 155-156, Table LXV) filling cavities of the Cretaceous formation and composed of high grade mate-

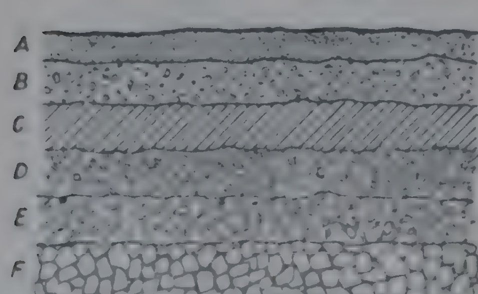

Fig. 153 — Ideal section of the nitrate beds: A "chuca", B "costra", C "caliche", D "congelo" E "coba", F bed rock of the cordillera

rial, but these deposits are not plentiful and are difficult to extract. The stratified deposits belong to two types; the oldest have the following formation:

Covering stratum	. . . .	*chuca*
		costra
Profitable ,,	. . . .	*caliche*
Lower ,,	. . . .	*conjelo*
		coba

Under the *coba* lies the rock of the Cordillera de la Costa.

The surface of the soil is dusty and covered by dry, flat stones, called *lajas* or *lozas* and sometimes by pieces of flint termed *mellizos*. The *chuca* is always white or grey loose earth, formed of Thénardite (Na_2SO_4) mixed with sand and clay.

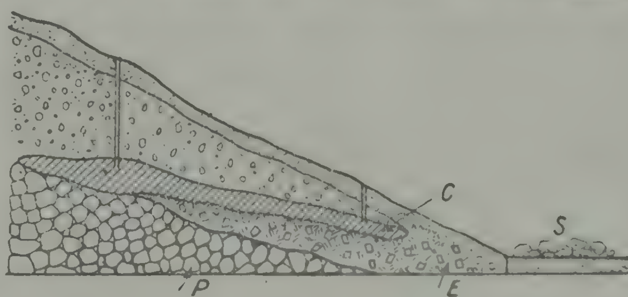

FIG. 154. — Arrangement of the strata in the nitrate formation: C "caliche", E "coba", porphyry, Sh "salar".

The *costra* is a conglomerate containing nitrate of soda in such a ratio that its extraction is not economical, insoluble materials, and chloride and sulphate of soda.

The *caliche* is the profitable layer and is formed of a mixture of salts soluble in water, and of insoluble and inert matter; there is a large proportion of nitrate, which seems to hold together the insoluble materials.

The *caliche* is formed of the following salts:—

(1) Nitrate of sodium, potassium, calcium and magnesium;

(2) Chloride of sodium, potassium, magnesium;

(3) Sulphate of sodium, calcium, magnesium and aluminium;

(4) Perchlorate of potassium;

(5) Iodine compounds = Iodate of calcium $Ca(IO_3)_2$ and iodochromate of sodium = $7\text{-}Ca(IO_3)_2 + 8\,CaCrO_4$ = Dietzite.

The insoluble material consists of rock, sand and clay.

The internal strata are unimportant; the *conjelo* is principally

formed of chloride and sulphate of sodium with a few insoluble materials.

The *coba* is a layer of loose, rather damp earth, mixed with small stones. This formation is often found on the gentle slopes of the Cordillera de la Costa, at a certain part of the valley and finishes at a higher point. The lower part of the deposit is always shallow and of a good grade; as it rises, the depth increases and the grade diminishes. There are also other deposits, termed *caliches de salar* in the lowest part of the soil with a small covering of *chuca* and containing a great deal of salt. The *costra y caliche* strata are not found as their place is taken by an intermediate layer called *caliche costroso*.

These *caliches de salar* are no doubt of a later formation: they contain much chloride of sodium and nitrate and sulphate of sodium in less quantity.

In some parts of these *salares* a mineral has been found termed *Darapskita* = $Na_2 SO_4, NaNO_3. H_2O$: the method and time of its formation is studied in another part of the present article and demonstrates the secondary origin of the *salares*. Some of these are formed at the present time in certain closed basins near the coast, where every night thick low-lying fogs occur.

The soil of the heights is damp enough to allow the waters to take to the bottom the soluble salts, which form horizontal layers owing to the evaporation during the day-time. There is also another kind of *salares* containing considerable quantities of chloride of potassium. They are formed by water that in the Cordillera de los Andes has dissolved salts of potassium and in the valley has evaporated near the nitrate formation. All these *salares* show a shrivelled surface, caused by the raising of the salt covering by expansion and contraction due to the sudden changes of temperature.

The *caliches* have different compositions, different percentages of salt, different colours and a variable physical appearance. On the whole, they are altogether dissimilar; some are very soluble, others are almost impermeable to liquids, some produce turbid liquids that cannot be decanted, others produce clear liquids

PLATE LXVI.

FIG. 157. — Soil section showing the different strata.

FIG. 158. — A block of strata. The numbers show their distribution, from above downwards according to fig. 157.

FIG. 160. — Drilling by hand labour.

FIG. 161. — Drilling by hand labour

IG. 162. — Excavating the soil and selection of nitrate material.

FIG. 163. — Mining the soil

PLATE LXVII.

FIG. 164. — Mining the soil.

FIG. 165. — Work of a special labourer who, after removing the soil with explosives, cuts a way in the *caliche* and selects the material.

FIG. 166. — Selection of useful material.

FIG. 167. — Selecting useful material.

FIG. 168. — Mechanical drilling.

FIG. 169. — Use of drill.

FIG. 170. — Use of mechanical drill and explosives breaking down the blocks. (This work was formerly done by hand, with hammers).

FIG. [illegible] — Mechanical drill

FIG. 172. — Mechanical shovel for removing the overlying strata.

FIG. [illegible] — Mechanical shovel.

FIG. 17[illegible] — [illegible]

Plate LXIX.


Figs. 175-176. — Selection and transport of nitrate.


Figs. 177-178. — Transport by carts from the *caliches* : loading into waggons.

Fig. 179. — Transport by railway.

Fig. 180. — A [illegible] from the [illegible].

Plate LXX.

Fig. 181. — Motor-lorries which are taking the place of mule carts.

Fig. 182. — Motor-lorry loading.

Fig. 183. — Installation of petroleum boilers of manufactory.

Fig. 184. — Idem.

Fig. 185. — Petroleum-heated boiler station.

[illegible]

PLATE LXXI.

FIG. 187. — Steam engines at a nitrate central station.

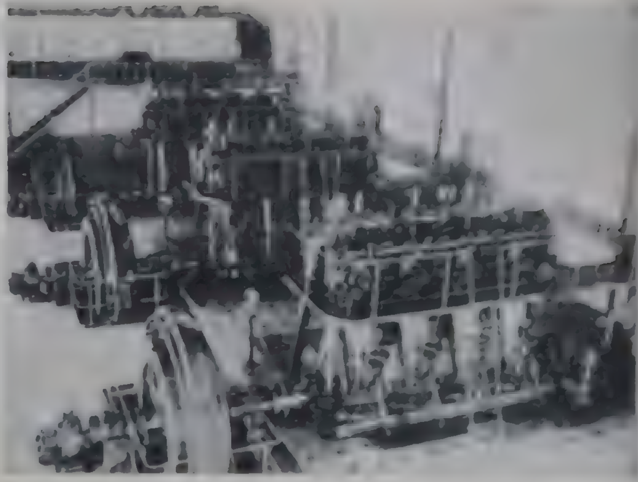

FIG. 188. — Diesel motors of another central station.

FIG. 189. — Hydroelectric central station on the river Loa, Nitrate Company of Tocopilla.

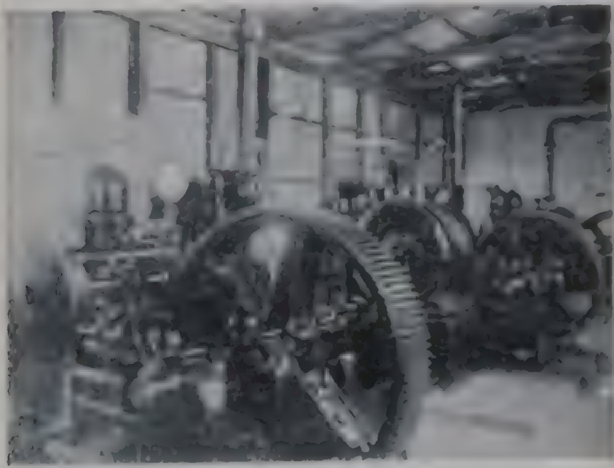

FIG. 190. — Pump installation in the river Loa for supplying water on the Pampas.

FIG. 191. — Crushing and purifying the caliche.

FIG. 192. — Grinding the caliche.

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The nitrate deposits are exploited by mining methods. Cuttings called *catos* or *tiros* are made in the soil, which is removed with explosives ; trenches are opened and the useful material is separated from the useless portion (Figs. 157, 158, Plate LXVI ; fig. 159, 160, 161, 162, 163, Table LXVI ; fig. 164, 165, Table LXVII). All this mining work has, during many years, been done exclusively and directly by hand, without the help of machinery. Only recently and in certain places has it been possible to drill, break and excavate by mechanical means.

Mechanical methods can only be used when the deposit has a uniform formation and grade, as a machine cannot select the materials. As, with the present mode of working, *caliche* is required having a definite grade, to avoid low profits it is essential that man should indicate what material has to be collected. (Figs. 166, 169, Plate LXVII ; figs. 170, 171, Plate LXVIII).

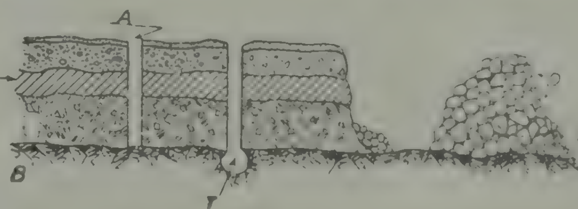

FIG. 159. — Diagram showing disposition of nitrate in the beds.
A = borehole, B = primary rock,
D = " caliche ", E = " costra ",
T = preparatory shaft.

A change in the method of working allowing the employment of a lower grade mineral than that used at present, — say of 10 %, — would cause a real transformation and a greater use of machinery. In the Pampas, with a burning sun and clouds of dust raised by strong winds, the work can only be done by men of strong physical constitution.

The *caliche*, having been separated into grades or *acopiado*, is carried to the installation, to the *Máquina*, as it is called, where it undergoes grinding and preparation (Figs. 172-174, Plate LXVIII ; figs. 175-180, Plate LXIX ; figs. 181, 182, Plate LXX).

The figures 183-186, Plate LXX ; 187-192, Table LXXI show boilers, steam-motors, Diesel-motors, and the hydro-electric central power station on the river Loa.

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The mining operations are less interesting to the chemist than those connected with the *caliche*, which consist of separating

out the nitrate from other salts and insoluble substances, and in crystallizing the nitrate in a commercial form, with a purity of 95 %.

The technique for the elaboration of Chilean nitrate was devised in 1809, by a German scientist, T. HAENKEN, of Cochabamba, who was in the Spanish Service.

An outline of the separation process is :

(*a*) The selective solution of the salts, especially the nitrate ;

(*b*) the separation of the salts in solution, or *caldo*, from the insoluble salts ;

(*c*) the separation, by crystallization, of the nitrate from the other salts in solution.

In the various processes it is necessary to consider the raw material, the soluble and insoluble substances, and the residue left after treatment.

Nature who always works well, has collected in the *caliche* three principal soluble salts : nitrate, chloride and sulphate of sodium, possessing very different properties, which makes their separation comparatively simple. On determining the concentration of a saturated solution of the above salts, at different temperatures, and of one salt independently of the other, it is found that the concentration of nitrate increases greatly at higher temperatures, the chloride increases a little and the sulphate decreases. When the three salts are mixed, the concentration of each of them, at the same temperature, decreases if compared with the independent concentration. The nitrate, no doubt on account of the greater work required for its solution, has a dominating effect which is shown by the curve of the chloride solution ; in this case the salt is dissolved less by heat than in cold solution. The *caliches* do not dissolve according to the recognized curves of pure salts, or of mixtures of these salts. The curve of solution of the *caliche* salts follows only the general form of the curve. In general, the concentrations obtained are lower than those of pure salts and this is caused by the difficulty of obtaining conveniently saturated solutions and, also, by the influence of soluble salts differing from nitrate. Thus, a *caliche* salt gives a solution with an over-saturation of chloride and with a less quantity of nitrate than the normal. In practice anomalies are sometimes found that seem to contradict technical forecasts.

The operation that is theoretically simple, shows itself to be different practically because the solution of the nitrate is hindered by the

excess of other salts and by the insoluble matter (Fig. 193). However, a method has been selected founded on A PROCESS OF LIXIVIATION AT THE MAXIMUM TEMPERATURE OF BOILING, AT ATMOSPHERIC PRESSURE, AND AFTER LIXIVIATION, THE CRYSTALLIZATION OF THE NITRATE BY COOLING WITH LIQUID AIR.

In practice, saturated solutions of *caliche*, at 90°-100°C. can be obtained that contain 600 gm. of nitrate, 150 of chloride and 60 of sulphate, and which, when cold, deposit theoretically, 250 gm. per litre, and leave a mother liquor containing 400 gm. of nitrate per litre.

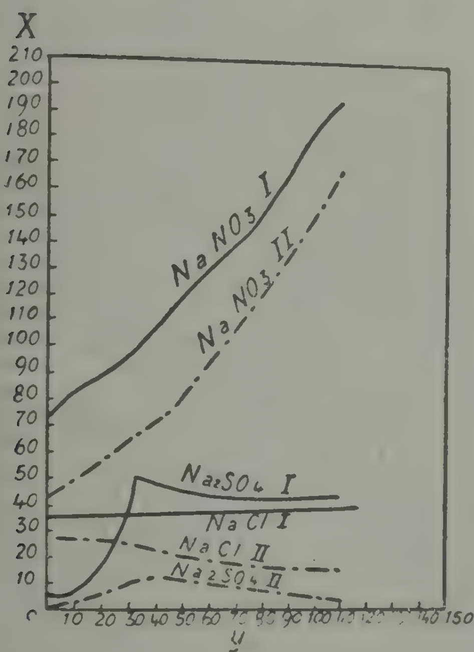

FIG. 193. — Solubility curves of nitrate, chloride and sulphate and of the three together.

x = grams of the salt dissolved.
y = temperature of the solution.

The removal of the chloride and sulphate has been mentioned, in order to make the nitrate more soluble. Such a solution should contain no extraneous salt when concentrated in a closed, high-pressure evaporation apparatus. It has been shown that, at a temperature of 120°C. and a pressure of 1.15 kg. per sq. cm., it is possible to precipitate all the chloride and sulphate from a *caliche*, when the maximum concentration of the nitrate is reached, about 1000 gm. per litre. During the concentration the chlorine and sulphate precipitate owing to deficiency of water and the lowering of their coefficients of solubility, while the nitrate dissolves in the liquid and increases its concentration. This method has been used in the concentration of nitrate of soda of at least 94 %, in order to obtain the almost pure nitrate of soda used for the manufacture of nitric acid.

The pressure and temperature is called critical, and the residual liquid can be almost entirely crystallised by cooling in vacuo, leaving almost no mother liquor.

The phenomenon of the precipitation of salts differing from nitrate and especially of chlorides, occurs only when the liquid is concentrated in the absence of *caliche* (fig. 194). When this is present, and

according to the quantity, the sulphate does not act and continues its precipitation. If among the undissolved salts of the *caliche* the chloride of sodium is in excess over the nitrate, the solution dissolves proportionately more chloride and very little nitrate, at a high temperature.

The solution process must therefore be very accurately controlled in order to obtain a conveniently saturated liquid in a definite time.

The method of working just described is suitable for *caliche* containing a high percentage of nitrate, with an amount below 50 % of soluble material. As these materials change, if the insoluble matter, and especially clay, increases, or if the saline materials and particularly the nitrate diminishes, the profit is not considerable. In order to obtain suitable concentrations a great deal of combustible material and much time are required. The solution does not generally increase its concentration by dissolving the nitrate but by evaporating the dissolving agent. When the available *caliche* had a suitable salt content, as was the case formerly, the yield was about 70 %; at present, with a 15 % material the yield does not exceed 60 %; besides, the amount of combustible required for each ton of nitrate produced has been considerably greater.

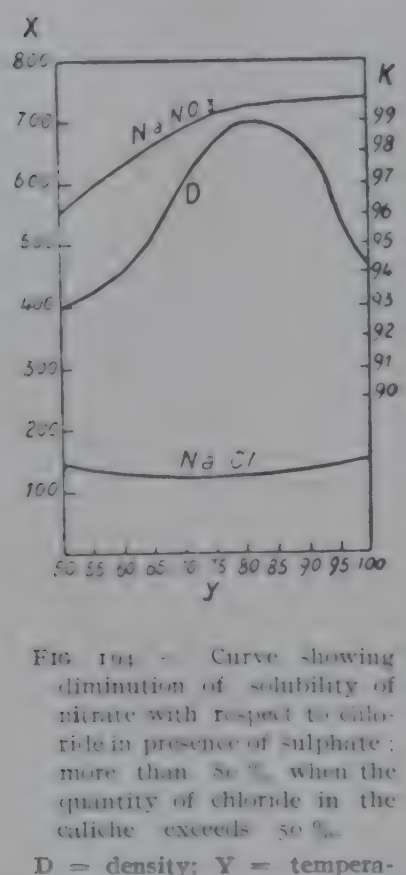

FIG. 194. — Curve showing diminution of solubility of nitrate with respect to chloride in presence of sulphate: more than 80 % when the quantity of chloride in the caliche exceeds 50 %.

D = density; Y = temperature; X = grams per litre; K = density.

It was proposed to concentrate the liquids at a temperature of about 80° C., submitting afterwards the separate lixiviation liquids to concentration in an evaporation apparatus. This method cannot be followed because of the precipitation of large quantities of chloride that obstruct and ruin the evaporation apparatus, besides, the high temperature of steam decomposes the salts of magnesium, separates the iodine and causes electrolytic corrosion.

For concentration at a high temperature, the best evaporation apparatus has been employed, but its use cannot be continued because of the practical impossibility of separating the nitrate from the

common salt, which, precipitating in a liquid having a high nitrate content, still maintains a high percentage of this salt in solution.

It has been proposed therefore to proceed in a different way, that is, to prepare a solution at a lukewarm temperature, having as maximum 50°C. and to crystallize by cooling not in the open airat the surrounding temperature, but at lower temperatures, about 0°C. by artificial cooling. Studying the technique of this process, with the help of the curves formed for pure salts, it is found that, at this temperature solutions are formed, with about 550 gm. of nitrate per litre, that, when cold, deposit about 225 gm., a quantity almost equal to that given by the early method (fig. 195).

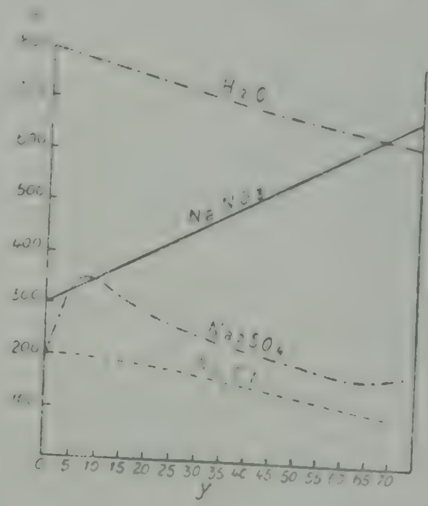

FIG. 195. — Solubility curves of nitrate, chloride and sulphate of soda 0° — 70° C.
x = grams per litre.
y = temperature.

The difficulty met with in using this method that may be called A PROCESS FOR THE RECOVERY OF THE NITRATE FROM CALICHE BY ARTIFICIALLY COOLING THE LIQUIDS RESULTING FROM LIXIVIATION, is even greater than in the former case.

In the first place, the solubility of the salts found in the *caliche* follow only approximately the form of solution curves of pure salts, and the concentrations obtained are not so suitable. Secondly, not all the *caliches* are susceptible of being efficiently lixiviated at the surrounding or tepid temperatures ; the solution depends in this case on the saline composition of the *caliche*, excepting the chloride of sodium. Lixiviating a *caliche* at the above temperatures the solution concentrates first in chloride of sodium and nitrate and the sulphate dissolves afterwards. When the solution contains equimolecular proportions of both salts and has reached the concentration of 216 gm. of nitrate per litre, an insoluble compound is formed named *Darapskita* ($NaNO_3, Na_2SO_4 . H_2O$), already mentioned in connection with the nitre formation called *caliches de los salares*.

The *Darapskita* already exists in some *caliches* and is formed whenever the proportions of nitrate and sulphate are equimolecular. It is insoluble at 20°C., in a solution equal to or above 216 gm. of

nitrate, and at 45°C. in more than 360 gm.; separates partially with an elevation of temperature and completely at 60°C.

For the lixiviation of the *caliches*, at the surrounding or tepid temperatures, the nitrate present in the raw material must be considered under two forms: combined with the sulphate and as free nitrate that dissolves and increases the concentration of the solution.

On this account the solutions are far from having the necessary concentration for precipitating the nitrate economically, by artificial cooling.

The greater part of the *caliche* deposits, named *caliches de salar*, belonging to a secondary formation, has sulphate and nitrate proportions very near the equimolecular proportions and does not dissolve normally.

It may be considered that those deposits of *caliche* are formed by lixiviation at the surrounding temperature, of different materials situated in other regions and that solutions have concentrated and evaporated forming the *salares* in which is found the nitrate-sulphate, or *Darapskita*.

The difficulty has been overcome by Drs. BURDICK and FREED of the wellknown firm *Guggenheim Bros.* that has undertaken the study of this system.

It has been found that some radical elements or chemical substances take the place of the nitrate molecule in the *Darapskita*, combining with the sulphate of sodium and forming other insoluble compounds. These elements named *estabilizadores* or *estabilizantes* are among others: potassium at a concentration of 16 gm. or more per litre, that forms *Singerite* (K_2SO_4. $CaSO_4H_2O$).

Magnesium, at a concentration of 21 or more gm. per litre, that forms *Astrakanite* ($Na_2SO_4MgSO_4$. $4H_2O$).

Calcium, that forms the *Glauberite* (Na_2SO_4 . $CaSO_4$), a compound that has the advantage of requiring for its perfect consolidation less sulphate of sodium as the nitrate increases in solution.

The experiments have proved that the solubility of the total nitrate of *caliche* takes place: (i) with the increase of concentration of the consolidating substance, (ii) with the increase of temperature, (iii) with the quality of material used.

These factors, *estabilizantes* or *estabilizadores*, not only make it possible to extract by lixiviation all the nitrate from the *caliche*, but help the precipitation of nitrate by artificial cooling, obtaining a deposit of this substance greater than could be obtained in any other way.

When a liquid saturated at the surrounding temperature with nitrate, chloride and sulphate, is artificially cooled, the solubility of nitrate diminishes as the temperature decreases, while, on the contrary, the solubility of the sulphate increases, reaching the maximum at 7°C. At this temperature three solid phases coexist: nitrate of sodium, *darapskita* and sulphate of sodium; the change of solubility of the sulphate of sodium from 7°C to 0°C. is very quick so that, cooling at a lower temperature, we obtain a mixture of sulphate and of nitrate. Thanks to the materials the solubility of the sulphate increases, the transition point gets some degrees lower, the cooling temperature can be brought to about 0°C., increasing the yield of the nitrate obtained without damaging the quality.

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The insoluble materials of the *caliches* are also important in the lixiviation; they are formed of stones, sand, clay and the salts insoluble in the dissolving liquid, excess of chloride and sulphate of sodium. When the *caliches* contained much nitrate and few insoluble materials and no clay at all, they were porous and could be very well lixiviated, even if put in the tanks in relatively large quantities. At present, when the average amount of nitrate in the *caliche* does not exceed 20 % and the insoluble materials are higher than 50 %, it is very difficult to make the liquid penetrate. At first it was proposed to grind the material more, in order to present a larger surface to the dissolving liquid, but it was found that: (i) this produces sediments or *lodos*, very hard to decant; (ii) the saline, hot dissolving liquid separates more easily the insoluble matter when the *caliche* is ground into small pieces, setting free a greater quantity of light insoluble materials; (iii) in the tanks the hollows occupied by the dissolving liquid diminish, increasing the ratio between the solid matter and the volume of the dissolving liquid; the small particles produced fill the cavities and form impermeable coverings that must be broken down, to allow the circulation of the liquid in the tanks; agitation by air, steam and mechanical means, increases the sediments or *lodos* and the result is a very homogeneous mass in which it is not possible to separate the dissolving liquid from the used and exhausted matter. When the insoluble materials have a larger surface and a greater ratio of clay is present, the capacity for absorption of the dissolving liquid is increased, to the extent sometimes of 20 % or more of its weight. This

phenomenon limits also the lixiviation and does not allow the formation, with poor *caliches*, of a liquid with a high concentration of nitrate; then the fresh *caliche* treated with a concentrated liquid, obtained by heat, absorbs and increases its content of nitrate instead of setting it free in solution. Each *caliche* requires a special grinding, during which a part of the solid matter is ground into a fine dust that causes sediments and that must be separated in the tanks from the big pieces and from the ash, before lixiviation.

***

The nitrate industry was formerly a domestic industry; iron pots were filled with pieces of caliche from the soil, with a content exceeding 50 %, and boiled with water over stones in order to form a saturated solution. This was decanted and then cooled in a flat trough called a *batea*. The material treated in such a way gave 25 % or more of nitrate and the output was not great.

The real industry began in 1870 by the testing of various apparatus to find a process for lixiviation. But the problem was solved when Dr. S. HUMBERSTONE introduced in 1878, the lixiviation process of SHANKS, employed for crude soda in the LEBLANC process, adapting the tanks to hot treatment and raising them so that they could be discharged from the bottom. As is well known, the lixiviation process of SHANKS takes place with an excess over the solid matter, of the liquid that passes from one tank to another (fig 196), which is always brought into

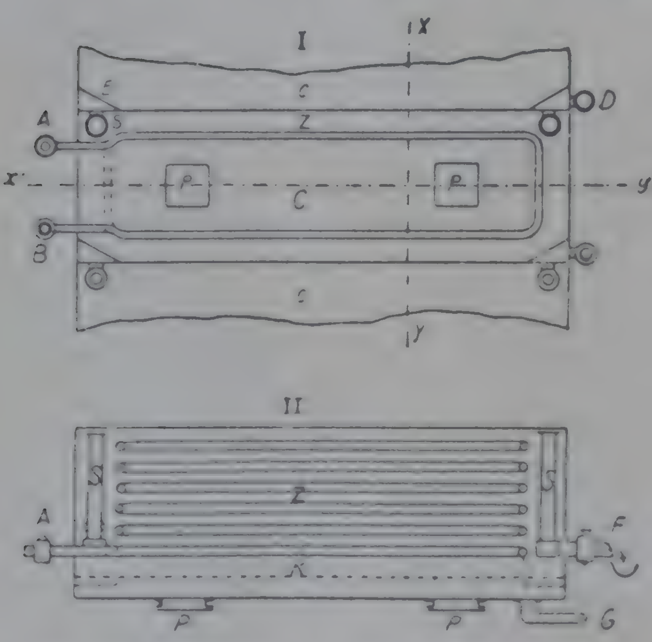

FIG. 196. — Section and plan of a lixiviating tank, or " cachuco ".

A = outlet for steam, B = inlet for steam, C = cachuco, D = outlet for solution, E = refill inlet of "chulleder", F = discharge deposit, G = discharge of the K = bottom plates, S = siphons, Z = condenser, c = cachuco, p = doors.

contact with fresh solid matter and thus increases its concentration. Elevating, at the same time, the temperature of the liquid, it becomes saturated with nitrate at the final temperature of lixiviation, viz., the boiling temperature of the solution at atmospheric pressure (1000 m. altitude). The movement of liquids is due to gravity, a higher column of a weak liquid takes the place of a lower one of concentrated liquid. The treatment is carried out in

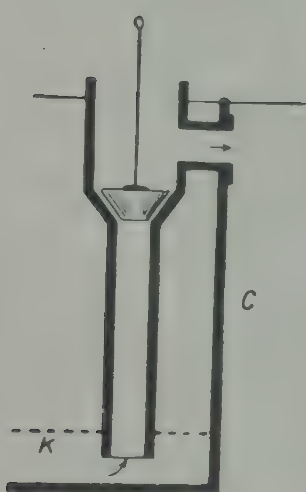

FIG. 197. — Old type of Shank's siphon.
C = "cachuco".
K = bottom plates.

FIG. 198. —Type of siphon now in use.
C = "cachuco".
K = bottom plates.

rectangular vessels of equal height and width, and a length six times these dimensions, and containing heating-coils and a perforated double bottom about ten cm. from the base. These containers, or *cachuchos*, stand 2 m. from the ground, over supports, and have holes in the bottom for the extraction of the exhausted materials, and sundry valves and connections.

Six, eight or more, are put side by side, connected by a siphon (figs. 197-198) called the *traspaso*; the long branch put in the *cachucho* that supplies, and the short one in the container that receives, the liquid. The working of this system is too well known to need any

description. It is thus possible to effect a number of transfers of the liquid, corresponding to a washing of the container that receives the dissolving liquid (*cachucho de cola*). Owing to the passage through the other containers the liquid comes from the head *cachucho* concentrated and at a suitable temperature.

The SHANKS process of lixiviation is a very rigid one that allows only a definite quantity of dissolving liquid, while the washings and the mother liquor must be lixiviated. The only fresh solvent available is the water evaporated during lixiviation and crystallization, that which is taken by the other products and residues and what runs over. The SHANKS process regulates methodically the concentration of liquid in the containers. With a concentrated head liquid the final liquids acquire a high concentration; it is not possible to go on washing indefinitely, owing to the volume of liquid which increases progressively. For a perfect washing, a set of containers is necessary twice as numerous as that now in use. This is not economic practically, because the expense increases the working costs; also, on account of the hydraulic passage system it would cause the mixing of a concentrated with a dilute liquid, and would thus make useless the work of solution; it is intermittent therefore, for increasing the temperature, the siphon must be closed for leaving the liquid in contact with the *caliche*, the *cachucho* having only steam during several hours.

The LEBLANC lixiviation method adopted, being at the surrounding temperature and having neither mother liquor nor washing water, had very little influence in the treatment of *caliches*. When it was adopted, *caliches* were porous, soluble, without sediments and with a high yield, the nitrate fetched a high price and combustibles and labour were cheap; now, the *caliches* are poor, every factor is unfavourable and the profits decrease slowly but surely.

An improvement has been tried by separating the big pieces from the small after grinding, lixiviating only the former and treating the latter differently, large sums of money have been spent with very small economic results. A reduction has been brought about in the temperature and final concentration of the liquid, which is concentrated separately in an evaporation apparatus, but the result is unsatisfactory.

As was mentioned above, an apparatus has not so far been found capable of economically concentrating the dilute solutions ([illegible]).

All these improvements serve to increase the yield of some parts

FIG. 199. — *Caliche* raised and discharged by a mechanical elevator.

FIG. 200. — Mechanical elevator.

FIG. 201. — Another type of elevator.

FIG. 202. — View from above of the platform used for placing the *cachuchos* on waggons.

FIG. 203. — View of *cachuchos* protected by wooden beams, and loaded on carts.

FIG. 204. — Load of *cachuchos* with endless transporter; on the left the heating coil.

PLATE LXXIII.

FIG. [illegible] — [illegible] with transporter and [illegible] out of small pieces.

FIG. [illegible] — The interior of a discharged [illegible]

FIG. [illegible] — The lower part of the [illegible]

FIG. [illegible] — The upper part of a discharged [illegible]

FIG. [illegible] — [illegible]

only of the total mass of *caliche*, and complicate subsequent processes, and require expensive installations, very difficult to maintain in the nitrate Pampas.

The *caliche* having been ground, and the dust and small fragments separated, the larger pieces are treated by the SHANKS lixiviation process (fig. 199, Plate LXXII).

As a rule the material has to be raised about 6 m. (figs. 200-201, Plate LXXII), to the level of the *cachuchos*, where it is distributed to the containers (fig. 202, Plate LXXII). The transport and distribution is carried out by means of various types of endless-band transporters, inclined planes, lifts, etc. (figs. 203-204, Plate LXXII).

Experience has proved that the methods of transport and the arrangement of the material in the containers are important in obtaining a good lixiviation, but sufficient attention has not been given to this fact. The material is thrown generally in the tank from the top, in order that it may fall on the perforated bottom; in this way the pieces roll over the heap formed on the bottom and the smaller materials separate from the larger, and assist movement of the liquid during lixiviation. Some *oficinas salitreras* put on the bottom of the container a thick and homogenous filter covering, and place over it the solid material, using automatic distributers that fill in the *caliche* evenly without hollows.

A certain quantity of concentrated solution having been taken from the head container the final container is washed out by inter-circulation and is emptied and drained, and the exhausted material taken away (fig. 206, Plate LXXIII).

The removal of the residues (figs. 207-208, Plate LXXIII) is carried out at a temperature of 40° C. by special workmen and entails heavy labour. The residues taken from the lower part of the *cachucho* are collected in waggons and thrown on large heaps at some distance from the factory. It is not likely that mechanical means will be used for carrying these residues, because of the 25 % or more of water that remains in them (fig. 209).

A system of lixiviation is now being tried in which instead of having the liquid pass over the solid matter, this has been introduced into containers full of solution (fig. 210, Plate LXXIII, 211, 212, Plate LXXIV). A movable tank is employed, through two sides of which pass perforated tubes: these tanks are conveyed to the lixiviation tanks by a swing-bridge. The exper-

iments so far made prove that the load is distributed more equally by the use of finely ground material, and no difficulty is experienced by the sediment blocking the internal circulation: lixiviation requires less time and the charging and discharging take place more quickly and cost less than with the SHANKS system. In the near future the SHANKS *cachuchos* may be transformed to this new type with great advantage in yield, combustibles and time.

* * *

Industrial experiments of another process for extracting nitrate from *caliche* have been made, which were mentioned when alluding to the solubility of the *caliche* salts. The lixiviation of the material is done at a low temperature, lower than 50° C. and the nitrate is precipitated from the solutions by means of reduction of the temperature to about 5° C., brought about by the aid of a freezing liquid. The mother liquor contains a relatively small quantity of nitrate.

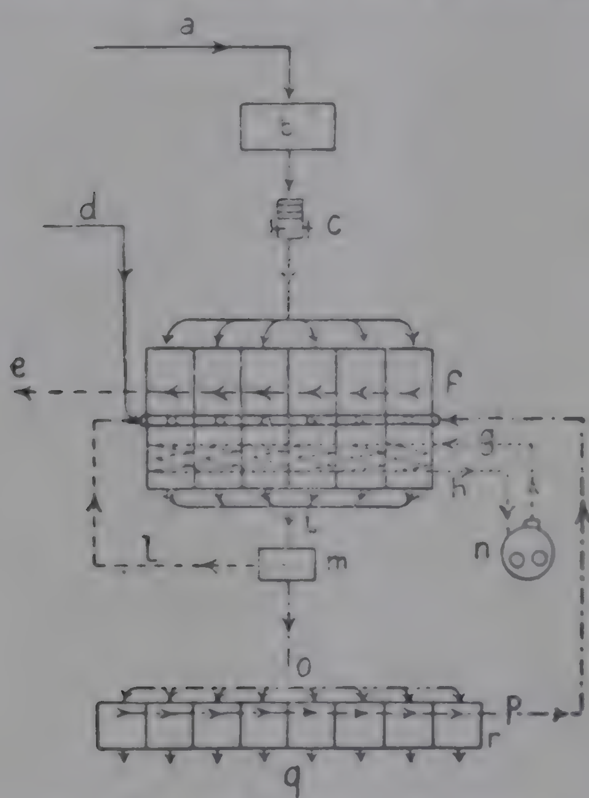

FIG. 200. – Arrangement of the Shank's process.

a = caliche, *b* = inclined plane, *c* = chancadores *d* = water, *e* = poor material, *f* = cachucos, *g* — steam, *h* = outlet, *l* = good material, *m* = chulladores, *n* = heater, *o* = saturated solution, *p* = water *q* = containers. *r* = nitrate bateas.

This process has given such interesting results that the firm of GUGGENHEIM Bros. proprietors of the patent, has built perhaps the greatest installation of the industry, in order to reduce more than two thousand tons of *caliche* per day.

This process is a continuous and cyclical one; a tepid solution is obtained saturated with nitrate that needs no intermediate treatment, the crystallization is continuous and rapid in mechanical apparatus; the lixiviation work does not

require any special combustible, the waste heat from the power installation being sufficient for this purpose (internal combustion engines and freezing liquid pressers). The experiments have been made with *caliches* containing only 10-21 % of nitrate and show a notable improvement in total costs. The process must certainly not be put aside as it gives a yield of about 96 %, can treat *caliches* of a low grade and diminishes the cost of extraction, having no need of the selction work required by the present system. As will be seen later, the method of using combustibles has made noticeable progress.

***

The solutions prepared in the *caliche* lixiviation, especially by the SHANKS process at a high temperature, cannot be immediately crystallized, but must be submitted to an intermediate operation known as *chulla*. This unites two different operations: the sediment, by the action of gravity on the insoluble materials in the liquid, precipitates fine sand, clay, and the residues of the solution. The solutions coming from the *cachuchos* have generally a super-saturation of chloride or of nitrate. In order to obtain their stabilisation the temperature of some grades must be lowered until the dissolved nitrate saturates the solution, while the chloride of sodium precipitates. We thus obtain a solution in which the proportions of water, chloride and nitrate have the same relation as the saturated solutions obtained with pure salts.

The *chulla* is carried out in tanks with an inclined bottom (fig. 213), and the liquid is removed by means of a siphon. The *chulla* lasts from 15 to 30 minutes, the time in which the liquid lowers, by radiation, tis temperature and the precipitated salts deposit with the insoluble matter. Abnormal *chullas* take place however when among the insoluble materials collodial clay exists, that require many hours to form a deposit and must first

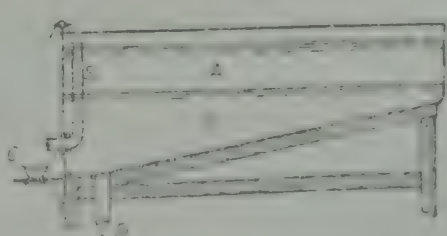

FIG. 213. — Chullador.

A = clear solution,
B = [illegible]
C = channel to bateas,
D = [illegible]
S = [illegible]

be flocculated. The *agrumación* or *floculación de las borras* has so far been made by physical methods, substances that coagulate by heat make a film and drag down the residues; only a few experiments on chemical flocculation have been tried. The problem of the residues must certainly be carefully examined.

***

The clarified and stabilised liquid is passed for crystallizatiion into large containers (figs. 213) called *bateas*, with the bottom inclined towards one side, and situated at a certain height. The hot liquid cools on contact with the air and the first crystals form on the sides of the *bateas* and over the liquid surface, hindering thus the passage of the heat and delaying the crystalization. It is necessary to detach the crystals and immerse in the liquid those formed on the uncovered surface, and that requires great care and much labour. This system loses all the latent and thermometric heat of the solution, about 7 % of the total heat used in the elaboration (figs. 216-217, Plate LXXIV; 218-220, Plate LXXV).

FIG. 214. — Container,

A = mother liquor,
B = liquid from the chulladors.

FIG. 215. — Bateas with sloping platform

S = nitrate,
A = mother liquor.

The experiments of rapid crystallization with heat recovery have not so far given good results, chiefly because the operations are not continuous and we cannot always profit by the recovered heat.

The liquid concentrated in nitrate at a pressure higher than the ordinary, having a boiling point higher than the normal, contains

PLATE LXXIV.

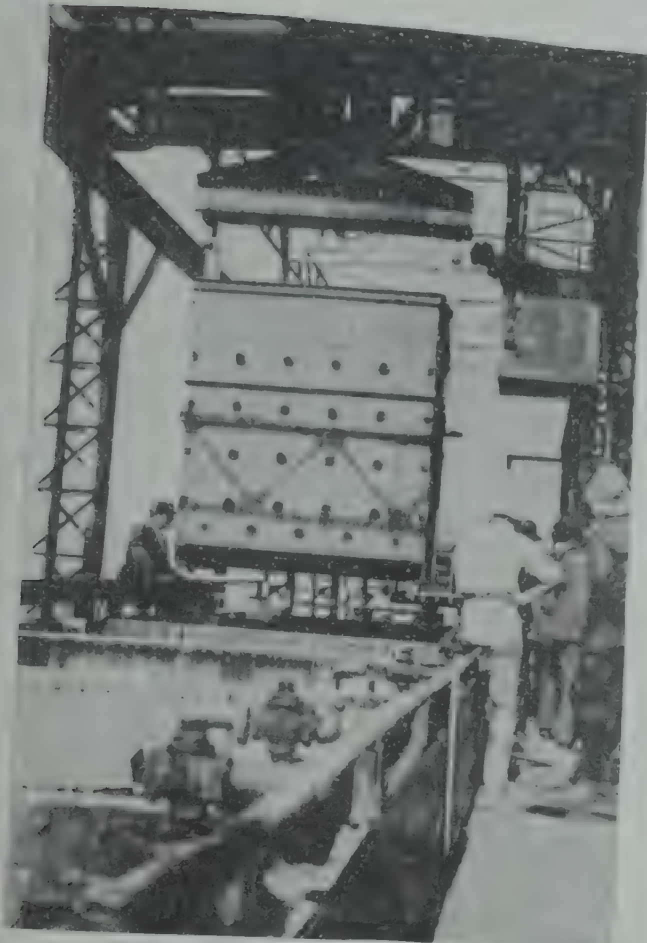

FIG. 211. — The moveable perforated container full of *caliche* is introduced into the *cachucho*.

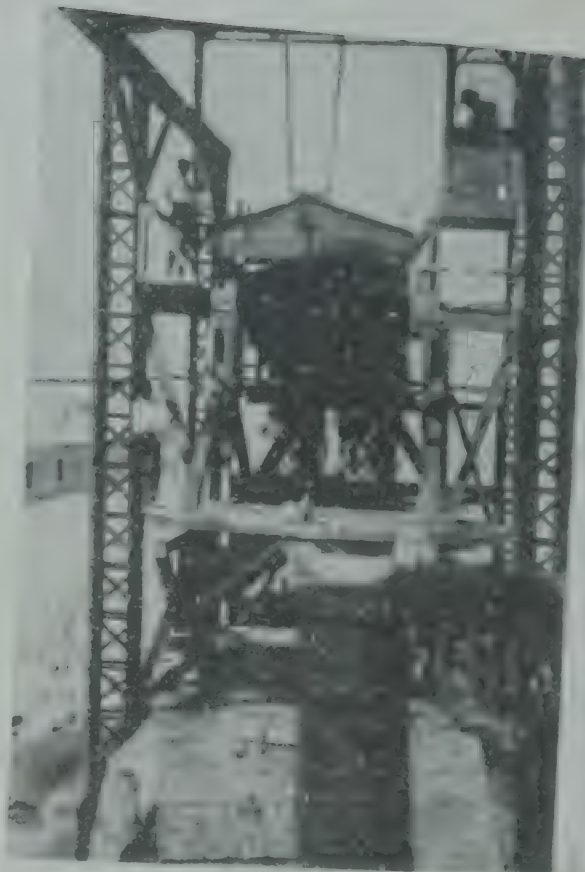

FIG. 212. — Discharge of the [illegible]

FIGS. [illegible]

PLATE LXXV.

FIGS. 218-219. — *Batcas.*

FIG. 220. — *Batcas.*

FIG. 221. — Bridge and accumulation of [illegible]

pratically no chloride of sodium and can be crystalized by an almost complete evaporation of the dissolving liquid. The experiments demonstrate the great mechanical difficulties. When the crystallization is completed — remaining 100 or more hours in the *bateas* — these are dried and the mass of solid matter is drained by heaping it in the highest part of the *batea*, and drying afterwards in the *canchas* (enclosures).

The nitrate that maintains a relatively high moisture in the form of mother liquor, of about 5 %, is dried by spreading in the open air and in the sunshine (fig. 221, Plate LXXV) in semi-permable *canchas*. A part of the water is absorbed by the ground, another part evaporates and, after some days only about 2 % moisture remains. The nitrate is then put into sacks ; these are marked and are ready for export (fig. 222, Plate LXXVI). The liquids already are lixiviated and sometimes treated especially for extracting the contained iodine.

The mother liquor, saturated with nitrate at the ordinary temperature, could certainly be treated in order to crystallize a greater quantity of nitrate.

To obtain another deposit of nitrate it would be sufficient to cool the water to about 0° C. During the war the mother liquor was cooled, crystallizing out a mixture of sodium nitrate with 30 % or more of potassium nitrate and the product was sold to the U. S. of North America as fertiliser.

***

The manufacture of nitrate by extraction from *caliche* requires the use of combustibles. It has been throught that the climate of the Pampas might be employed for the various nitrate processes with the least possible quantity of combustible. In the Pampas the average daily temperature is high and during the night below freezing point. The liquid evaporation is made easy by the height, the dryness of the atmosphere and the constant winds. It seems very simple to dissolve the *caliche* in water, at the ordinary temperature, use the sun's heat to compensate for the heat lost by dissolving the sodium salts in water, to evaporate the liquid, saturated with nitrate at the ordinary temperature, in the open air, and to collect the salts that precipitate during the evaporation of the lixiviation liquid which may contain a maximum of 50 % of nitrate. We could

thus obtain a mixture of salts with a concentration in nitrate of the low-grade *caliches* without having used any combustible.

The experiments show that it is not possible to compensate rapidly, by sun heat, the negative heat of solution of a salt that requires an enormous quantity of liquid for obtaining a balance in the temperature. They demonstrate also that the evaporation of water in the open air is more expensive, for the value of the lost water, than the cost of combustible. Besides, the lixiviation installation would be very large and the surface required for sun evaporation would occupy an impossible area. The combustible is, therefore, essential and is used for the production of the mechanical energy required in the preparation of the *caliche* and serves for transporting solid and liquid elements, for lighting the laboratories, etc., and for the production of the heat necessary to dissolve salts and separate nitrate from other soluble salts.

The mechanical energy consumed in the installation represents only a fraction of the combustible employed, about 6 %, but as more machinery is employed for taking the place of human labour and for grinding more finely the *caliche*, the consumption increases and may reach 10 %.

With the pure salts that are found in the *caliche*, mixed with 50 % of nitrate, only 200 000 calories per ton of crystallized nitrate should be needed ; for obtaining the concentrated nitrate at 100° C. the other salts are dissolved and crystallized, supposing that losses have taken place in the lixiviation process.

In practice, the necessary and occasional losses exceed the heat energy used ; these losses are caused :

(*a*) by radiation, by convection and conduction of the heat in the apparatus tubes, valves, etc ;

(*b*) by the hot materials removed from the lixiviation system, residues and sediments ;

(*c*) by the evaporation of water during lixiviation ;

(*d*) losses of heat corresponding to an elevation of temperature without dissolving a greater quantity of nitrate.

The above mentioned losses increase : with the greater difference between the final lixiviation temperature and the surrounding one ; with the percentage of insoluble materials removed during the lixiviation process ; with the time taken by the operations ; with absence of control in the lixiviation process ; with the defects of heat insulation in the installation.

Further, at present very hot solutions are extracted that crystallize by cooling in the open air, without recovering the latent heat, and form another source of loss of heat. The losses of calories, in the present system of elaboration at a high temperature, are on the average the following :

For each 100 *calories of combustible* :

(*a*)	Losses in the boiler	40 %
(*b*)	,, by radiation, convection and conduction .	13 %
(*c*)	,, by removal of hot residues	5 %
(*d*)	,, by water evaporation and reheating of the solution without any greater production of nitrate	27 %
		85 %

In the concentration of the liquid we may take advantage of 15 % of the combustible heat, raising the temperature of the solid and liquid elements and neutralising the negative heat of solution of the dissolved nitrate. The thermometric heat corresponds to 8 %, that is lost during the *chulla* and crystallization by cooling in the open air.

It is evident that many losses may be reduced to a considerable extent : by modern installations of boilers ; by more careful heat insulation ; by a final lixiviation temperature lower than the boiling temperature of the solution ; by recovering the heat that is now lost and may practically be recovered by interchanges (hot liquids that come from the lixiviation with cold ones that go into it). The calorific yield of the process can perhaps be increased by 25 %.

It is clear that, requiring heat and mechanical energy in the nitrate elaboration, we can obtain, owing to a combined system of production of mechanical energy and heat, a diminution in the quantity of combustible, using only one installation instead of two as at present in most of the laboratories.

For the hot elaboration methods mentioned named viz., the final temperature of which is near boiling point at the normal pressure of the saturated solution, we can draw up the following scheme of consumption for 100 thermal units of combustible.

Combustible

100

↓

High pressure boilers with recoverers, induction-tubes, reheaters, etc.

↓

35 % (consumption)

↓

High pressure motors for producing mechanical energy.

↓

15 % (consumption).

↓

Lixiviation and evaporation system

↓

50 % (available)

About 10 % of the available 50 % could be recovered.

The following is the scheme for the process of tepid lixiviation, up to 60° C. with internal combustion motors and the use of the lost heat :

Combustible

100

↓

Internal combustion motor

Electric energy	Calorific energy	Heat of the recovered combustion gases.
↓	↓	
31 %	63 %	
Mechanical energy employed impossible to recover	Recovery of the ammonia compresser heat . . . . 10 %	Heat from the cylinder of the refrigerator.
↓	↓	
20 %	Available calorific energy . . . . 73 %	

At least 40 of the available energy can be recovered.

As in this case the final temperature of the system is lower than in the hot system (at least 40 %), we can use all the lost heat, with a greater yield than in the former case although with a lower potential. As we have seen, the tepid process, allows a much better use of combustibles.

***

The Chilean nitrate of sodium is sold with a guarantee of purity of 95 or 96 % of sodium nitrate, determined by the differential method, deducting from 100 % the impurities: moisture, chlorine expressed as chloride, sulphates and borates, etc., expressed as sodium sulphate.

The *Asociación de Productores de Salitre* fixes the prices according to the market and the consumption.

The cost of production of Chilean nitrate, is very variable, depending upon many factors that are influenced by numerous and various causes. Firstly, the condition of the world market for nitrogen; when the consumption diminishes, the price decreases; the international exchanges, the weather and the crops have also an influence. The trade restriction causes a fall in the production (this is now, in respect to its total capacity, about 60 %), the fall in production causes a fall in the price of manual labour. The exchange of the pounds sterling in respect to Chilean money has its influence also; nitrate being sold in English money, and internal consumption and manual labour being paid in Chilean paper-money, a greater value of the pound gives the producer a larger profit.

The total average cost of the whole production may be classified under various heads; fifteen years ago they could be distributed thus:

Fiscal taxes	45 %
Materials	7 %
Carriage and transport	10 %
Manual labour	20 %
Combustibles	12 %
General expenses	3 %
Interest, sinking-fund, etc.	3 %

The same factors have, nowadays, a different value and can be thus distributed:

Fiscal taxes	38 %
Materials	9 %
Carriage and transport	11 %
Manual labour	22 %
Combustible	15 %
General expenses	3 %
Interest, sinking-fund, etc.	2 %

— *Agr. ing.*

According to North-American experts who, at the order of their Government studied in Chile the cost of nitrate, the average cost per ton is:

Primary cost	$ 12.96
Secondary "	$ 16.72
Total cost . . .	$ 29.68

The primary cost is what is called in the industry *coste en cancha* and includes: cost of extraction, carriage, elaboration, administration, sinking-fund and interest and depreciation of machinery and of the land. The costs vary considerably for each establishment. The secondary costs include: bagging the nitrate, carriage to the port, the cartage and embarking at the port, taxes and commissions. This is an almost invariable factor for every establishment. The primary cost is calculated by the number of tons of *caliche* brought into the installation and depends chiefly upon two factors: the nitrate content of the *caliche* and the extraction yield.

The North-American experts stated: that the price they fixed is an average price that can be maintained for several years, that nitrate selling at the present price of $41.80 per ton, the industry receives a guaranteed profit, but, if the price diminishes to $36 the Chilean industry will no longer be able to extract sodium nitrate profitably.

This pessimistic conclusion seems rather exaggerated because the industry can reduce the cost by improving the present yield, modernising the installations, adapting methods that are new, but have been so far sufficiently proved, paying less in taxes, organising the service of purchase, of sale, of carriage, all of which are possible and are already being put in hand.

The most important item is, no doubt, the substitution of the present SHANKS elaboration system by others that are more efficient; there are methods that have been sufficiently tested and factories are built for using them in practice. Later on, the above changes are sure to effect a noticeable transformation in the methods of extraction of the Chilean nitrate and a reduction of its cost.

Besides, the competition of the Chilean nitrate and similar synthetic, or natural substances, is of little consequence because of the always increasing need to supply human food in larger quantity and at a lower price, in order to avoid the race perishing. The nitrogen

requirement will therefore, probably increase at a greater ratio than the total nitrogen production.

To fix atmospheric nitrogen, by any one of the processes so far known, we need a quantity of energy much greater than the energy required for *caliche* extraction. The cost of this energy, whatever its origin (water, coal, petroleum), is inclined to rise and to be absorbed by other industries that can give for it a higher price. The most industrial countries, those in which the industry of nitrogen fixation is now beginning to develop, are, undoubtedly, those that will be obliged to turn to more profitable industries.

BELISARIO DIAZ OSSA,
Professor of Chemistry of the University of Chile, General Secretary to the Scientific and Industrial Nitrate Institute, Santiago.

THE DOMESTIC ANIMALS OF ROUMANIA.

Stock breeding was in a very flourishing condition in Roumania in the first half of the last century, when Roumania exported, mostly to the countries of Central Europe, cattle and horses for army service. In consequence however of the protective duties imposed by Austria-Hungary and Germany, this exportation ceased, stock breeding fell into disuse and the breeds degenerated. The number of domestic animals however continued to increase, though slowly, until the world war.

After the war, the area of Roumania was increased by the provinces which until then had been under the Austro-Hungarian dominion, and where, consequently, the protectionist régime had been in force, and breeding was evidently thus in a more prosperous condition than in the provinces of the Former Kingdom of Roumania.

The war caused great scarcity of livestock, especially in the Former Kingdom, where the number of animals has not yet reached the pre-war figure. It is however increasing rapidly. The number of domestic animals in the whole of Roumania in 1925 is as follows:

Horses	1,828,129
Oxen	5,553,871
Buffaloes	185,280
Sheep	12,480,967
Goats	584,747
Swine	2,924,603
Asses and mules	14,359

BREEDS

The principal breeds of animals in Roumania together with their characteristics are given below:

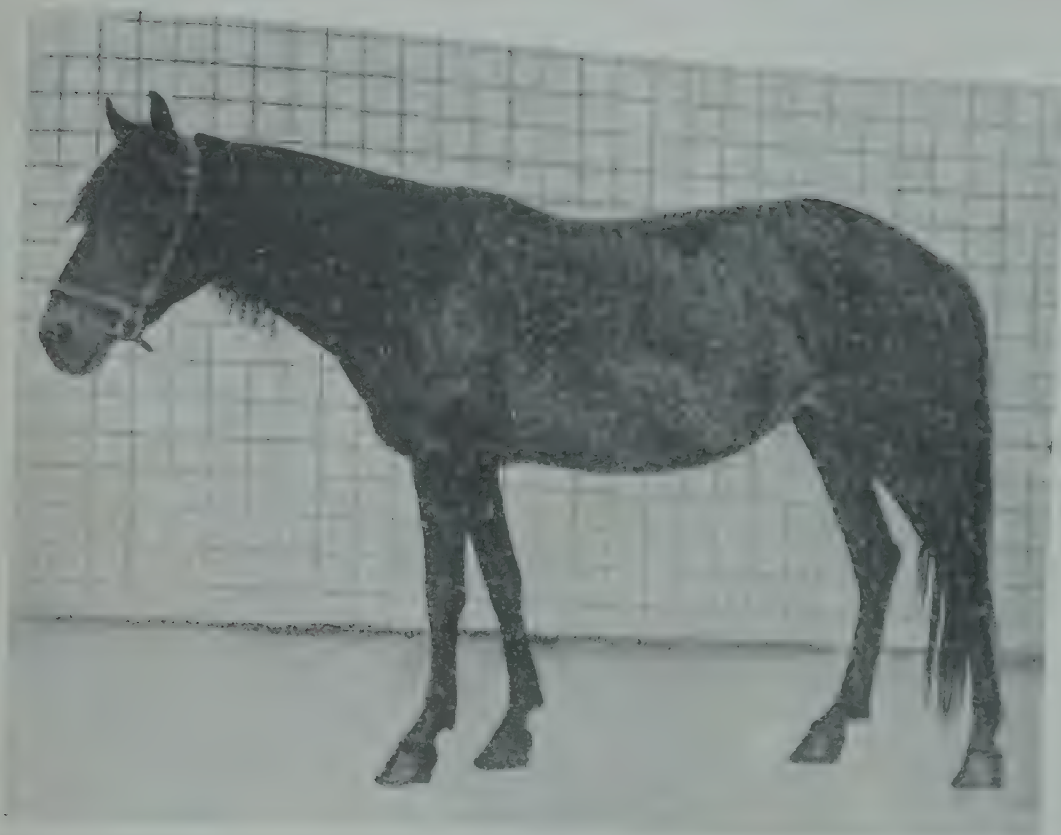

FIG. 223. — Mare, Roumanian breed, Moldavian variety (after Filip).

FIG. 224. — Mare, mountain breed (Filip

PLATE LXXVIII.

PLATE LXXIX.

FIG. 226. — Bull, Steppe breed. Moldavian variety.

FIG. [illegible] — Cow, Steppe breed. Moldavian variety (Filip)

PLATE LXXX.

FIG. 228. — Herd of cows, Steppe breed, Moldavian variety (Filip).

FIG. 229. — Ox, Steppe breed

PLATE LXXXI.

FIG. [illegible] Cow, Roumanian Mountain breed, after Filip.

PLATE LXXXII.

FIG. 231. — Bull, Simmenthal breed, bred in Roumania

PLATE LXXXIII.

FIG. [illegible].—Simmenthal milch type, bred in Roumania.

PLATE LXXXIV.

FIG. 213.—Communal herd of cattle, Simmenthal breed.

FIG. 214.—Ox, Pinzgau breed, bred in Roumania.

I. Breeds of Horses.

A. *Autochthonous Breeds*. Roumania possesses first an indigenous, high spirited breed of small size, which includes the following varieties : (1) the *Moldavian horse* (fig. 223 Plate LXXVII), formerly of high reputation, to-day very defective owing to the decline in breeding. This horse has the characteristics of the Arab ; its height to the withers is 1.40-1.45 m. (the best specimens reach 1.50 and the worst less than 1.40 m.) ; the head is square, the ears small, the nostrils expanded, the withers not too prominent but evident, the back generally long, the croup short and low, the tail well attached, the chest narrow, the limbs slender and well proportioned, the fetlocks slender, the hoof hard, the set of the leg generally incorrect (cow elbows), the skin fine, and the weight from 300-400 kg. It is a slow animal, requires little care and possesses great endurance. (2) The *Dobrugian horse* resembles the foregoing, but is rather smaller, being 1.30-1.35 m. in height. (3) The *Transylvanian horse*, taller (1.50-1.55 m.), weight 400-450 kg., of less noble form, is also found in the Wallachian plain in the Department of Ialomitza, whither it has been imported by the Transylvanian immigrants under the name of *Ialomitza horse*, now very rare. (4) The *mountain horse* (fig. 224, Plate LXXVII), small and thickset, height 1,25-1.30 m., weight 300-320 kg., bred and worked by the inhabitants of the mountainous regions of the Carpathians.

There is still another autochthonous mountain breed in Roumania, the *Hutzul*, found in Bucovina, and in Poland also and Eastern Galicia. It is small, 1.31 m. to the withers and 350 kg. in weight ; it is a mountain breed, of compact body with bushy tail, mane and forelock ; the fetlock is 16.6 cm., the hoofs short, the chest broad and low.

The German farmers of South Bessarabia breed a horse known as the *German horse*, of large size (1.51-1.65 to the withers), slow, with a thick coat, large head, low withers, long back (up to 10 cm. longer than the height at the withers), croup short and oblique, limbs weak and defective, fetlocks slender, hair long ; this horse is the result of various crossings with Ardennese and Orloffs. It shows great variability of character, and is used for farm work.

B. The *breeds imported* and reared in Roumania are : the *thorough-bred English horse*, for the breeding of which there are about 20 pri-

vate stud-farms in the Country and two large racecourses at Bucharest; the *thoroughbred Arab*, which is found only on the State stud-farms, the *halfbred Arab and English* the *Lipitzan breed*, the *Nonius Anglo-Norman* variety, (fig. 225, Plate LXXVIII), comprising the large and small Nonius, the *English-Arab "Gidran"*, the Orloff breeds and the draught breeds: the *Percheronne*, especially in some hilly districts of Moldavia, the *Ardennese*, especially in Bessarabia, and the Pintzgau, especially in Banat, where the lighter Mura variety is found.

II. Breeds of Cattle

A. *The autochthonous breeds*, of which Roumania possesses the *Steppe breed*, an excellent worker largely used for ploughing, and the *mountain breed*.

The following are the varieties of the *Steppe* breed: (1) the *Moldavian ox, Bos taurus primogenius dacicus* Werner (figs. 226, 227, Plate LXXIX; 228, 229, Plate LXXX), with horns averaging 35 cm., usually in the form of a lyre, silver-white or ash-coloured coat, the neck deeper in the bull, height to the withers 1.30-1.41 m., the back defective, croup often higher than the withers, breast narrow and low, hindquarters but little developed, high on the feet and of a slow type, the Moldavian ox is very hardy and of lively temper, with a quick step and great drawing strength; the calf at birth weighs 20-25 kg. and the adult as much as 600-650 kg.; when fattened it may reach 900-1000 kg.

The cows give 1000-1500 litres of milk per year with an average percentage of 4-5 % of butter. (2) The *Boucsan ox*, greatly resembles the Moldavian ox, but is less tall (1.30-1.35 m.), broader, more compact, more thickset, with smaller horns and a deep ash-coloured coat. (3) The *Ialomitza ox*, bred in the south of the Country, possesses all the characters of the Moldavian ox, but is narrower and longer and has larger horns; it resembles somewhat the Transylvanian ox, to which it is related owing to the immigration of Transylvanians in the district of Ialomitza. (4) The *Transylvanian ox* is characterised by the enormous length of its horns and by a greater height than the other varieties of the Steppe breed.

The *mountain breed* (fig. 230, Plate LXXXI) is a small animal averaging 1.17 m. in height, weight 330-350 kg., with short semicircular horns, a fine skin and glossy short hair; the coat is generally

FIG. 235. — Brown Swiss cow bred in Roumania.

FIG. 236. — Herd of Dutch cows raised in Roumania.

PLATE LXXXVI.

FIG. 237. — Ram, Tzigaia breed, White variety (after Filip).

FIG. 238. — Turcana ram, white variety (after Filip).

PLATE LXXXVII.

FIG. 239.— Flock of sheep at pasture, Tzurcana breed; black and white variety.

FIG. 240.— Flock of sheep at pasture, Spanca breed.

FIG. 241. — Karakul breed of sheep, raised in Roumania.

FIG. 242. — Karakul [illegible], bred in Roumania.

PLATE LXXXIX.

FIG. [illegible].—Mangalitza Sow after Fillip

ash-coloured, lighter at the nape of the neck, the back and underneath, with a light zone round the muzzle, like the Schwyz breed. The mountain cows are better milch cows than those of the Steppe. Many of them give 10 litres of milk per day during the maximum period of lactation, with an average of 4-5 % of fat ; their origin is still undecided, and it is not yet clear whether they spring from the acclimatisation of the Steppe breed to a mountain life, or are of other origin. The animal has been improved by crossing with the brown Swiss breed, but the work of selection is still in its initial stage.

B. *Imported breeds* raised successfully and on a large scale in Roumania, especially in Transylvania and the Banat, are the *Simmenthal* (figs. 231, Plate LXXXII ; 232, Plate LXXXIII ; 233, Plate LXXXIV) and the *Pinzgau* (fig. 234 LXXXIV) and in some mountainous districts, the *Schwyz* (fig. 235, Plate LXXXV). Attempts have been made to acclimatize the Shorthorn and other heavy, early-maturing butcher's beasts, but without success. Here and there Dutch cows are reared (fig. 236, Plate XXXV).

III. Breeds of Sheep.

A. *Autochthonous Breeds.* In Roumania there are two autochthonous types of sheep : (1) The *Tzigaia breed* (fig. 237, Plate LXXXVI) with fine wool (average 31 μ) is of two varieties : the white (head and extremities black, red or all plain white) and the black ; (2) the *Tzurcana breed* (Zachelschaf) (figs. 238, LXXXVI ; 239, Plate LXXXVII) with long, thick (56 μ) wool mixed with down, gives the varieties *white*, *black* and *grey* (from the last named the grey lambskins are obtained) and the variety known as *ratzka*, with spiral horns, which is found in the districts along the Hungarian frontier. The cross between the Tzigaia and Tzurcana is called "*Stogoshes*".

The Tzigaia and Tzurcana breeds furnish meat and milk in addition to wool. Certain cheeses are made with their milk, particularly a kind of gruyère (the "Cascaval"), also pressed cheese in skins ("Burduf"). The black Tzigaia is particularly noted for its meat ; it comes from Dobruja and is also called the *Bulgarian sheep*, while the black Tzurcana has been largely crossed in Bessarabia with the *Karakul* breed to obtain highly appreciated black furs.

Besides these two breeds, the Spanca (fig. 240, Plate LXXXVII) is found in Roumania. It originates from the Merino, but is autochthonous ; its wool is also finer than that of the others (25 μ) and

it is mostly found in Dobruja and Bessarabia, where it has been crossed with the Merino.

B. As *foreign breeds*, the Merino, *Frisian* and Karacul (Buchara) are bred. The first two have been employed for crossing with the Tzigaia, but the result has not yet been subjected to a rigorous test in conformity with the modern knowledge of heredity. The Buchara is mostly reared in Bessarabia, but also in the Old Kingdom (figs. 241, 242, Plate LXXXVIII).

The *English butcher's breeds* have been introduced in very small numbers and are not much bred.

IV. Breeds of Goats.

Goats are not raised to any extent in Roumania. There is a native *Carpathian* breed, and the *Saanen* goat has also been imported, but not in large numbers.

V. Breeds of Pigs.

A. *Autochthonous breeds*. The most famous indigenous breed is characterised by a long snout, pointed straight ears, its back convex and having bristles along the fore part, a narrow breast, undeveloped hindquarters, and long trotters, thus resembling the boar in character. In the mountain areas they are smaller, and known as "*stocli*"; in the plain washed by the Danube they are larger, and known as *marsh pigs*.

There is also a local breed; according to Professor Filip, it is the *Palatine pig*, but is not numerous; it has drooping ears.

The *Bazna* is another autochthonous breed, originating in a locality of this name in Transylvania. It is characterised by its colour, black with a white band round the middle of the trunk. It is a cross between the Mangaliza and Berkshire breeds.

The *Mangalitza breed* (fig. 243, Plate LXXXIX) found in all the Balkan countries, is very numerous in Roumania; its hair is curly, and it is noted for fat production. There are two varieties: the *white* and the *black*.

As regards *imported breeds*, a large number of Yorkshire are reared in all parts, and the Berkshire, especially in Bessarabia.

VI. Breeds of Poultry.

The *common local* hen has all the characters of the Italian hen; it is generally partridge-coloured, sometimes white and more rarely black.

The *Transylvanian hen* is a native breed; the neck is denuded of feathers; the bird is a good layer.

All the other more important breeds of poultry existing in other countries are found in Roumania.

MEASURES FOR THE ENCOURAGEMENT OF BREEDING

I. State Intervention.

The stock breeding work of the State is under the General Stockbreeding and Veterinary Sanitary Administration of the Ministry of Agriculture. This General Administration is under the control of veterinary surgeons and has, as auxiliary consulting and executive organs, besides the General Stock Breeding Inspectors, a Higher Stock Breeding Council, and in each Department a Departmental Stock Breeding Commission. These Departmental Commissions have autonomous financial means derived from different sources.

The State takes part, both directly and indirectly, in the breeding of domestic animals.

A. The direct State intervention is comparatively important as the State possesses 5 national stud farms, 10 stallion depôts, 3 national breeding stations for cattle, 4 national sheep stations and several small pig-breeding farms.

The National stud farms are: (1) The *Redautzi Stud Farm* in Bucovina, installed in the grounds and in the buildings of the former Imperial Austrian Stud Farm, but in greatly reduced proportions; indeed, owing to the distribution of the land to the peasants in accordance with the Agricultural Reform, there remain scarcely more than 3279 ha., of which 2000 are occupied only by an isolated pasture on Mount Lucina. The half-bred Arab is reared on this farm; there are also some pure-breds and others of the *Hutzul* breed. The farm has 25 brood mares and 6 breeding stallions of Arab race. The following were the names of the stallions on this

farm in 1924 : Gazal V (purebred Arab), Siglavy-Bagdady V (pure Arab), O-Bajan III (pure Arab), Dahoman XXII (half-bred Arab), Schagya XV (half bred Arab) and Schagya XIX (half-bred Arab).

There are also 16 mares and 2 breeding stallions of the Hutzul race ; the Hutzul stallions in 1924 were : Hroby VII and Gocal XIII.

(2) The *Rusetzu Stud Farm* in the Department of Braila, situated in a steppe region in the former Crown Domain, expropriated after the agricultural reform. The area occupied by the stud farm is 2600 ha. A part of the old buildings has been preserved, another has been reconstructed and a third is still in course of construction. The English-Arab *Gidran* variety is bred at Rusetzu ; the farm has 38 brood mares and 6 breeding stallions.

The stallions there in 1924 were : Gidran-Bakony II, Gidran XLVIII, Gidran L, Gidran LI, Gidran LII and Gidran LIII.

(3) The *Partza Stud Farm*, situated in the Banat on a former private estate, is the most recent installation. A part of the buildings has been preserved, another is still in course of construction or projected, the work being carried out as and when funds become available. The area of the stud farm is 1 496 ha.

Here also the "*Great Nonius*" Stud Farm is installed. This farm possesses 70 brood mares and the following 8 breeding stallions : Desentor (English thoroughbred), Verdun (English th.-b.), Durezas-Nonius II, Nonius XXVIII, Nonius XXVII (fig. 225), Nonius XXXII, Nonius XXXIII and Nonius XXV.

(4) The *Bontzida Stud Farm* situated in Transylvania, near Cluj, in the buildings and on the ground of a former Hungarian remount depôt, with an area of 1600 ha. The "*Little Nonius*" and *English heavy half-bred* (Furioso and North-Star family) are bred here.

On the Little Nonius Stud Farm there are 69 mares and the following 7 stallions : Hangos (English th-b.), Vulcan (Eng. th-b.), Filou I (Eng. half-bred), Nonius XXII, Nonius XXIII, Nonius XXX, Nonius XXXIV.

On the heavy half-bred farm there are 32 mares and the 4 following stallions : North Star XVII, Furioso XXXI, Furioso XXXII, Furioso XXXIII.

(5) The *Fagarasi* (*Sambta*) *Stud Farm*, situated in Transylvania on the former Hungarian stud farm of the same name, has an area of 500 ha. Here there is a small stud of the *Lippiza* breed with 32 brood mares and the following 3 stallions : Conversano XIII, Majestoso XVIII and Tulipan II.

The Stallion Depots are: (1) The *Anadokiol-Constantza depôt* in Dobruja, Constantza Department, with an area of 2200 ha.

(2) The *Rusetzu depôt* adjoining the stud farm of the same name and under the same administration.

(3) The *Slobozia depôt* on the plain washed by the Danube (Ialomitza Department).

(4) The *Grassi depôt* with an area of 1255 ha., in Moldavia, near the Carpathians (Neamtzu Department).

(5) The *Radautzi depôt* adjoining the stud farm of the same name and under the same administration.

(6) The *Fitesti depôt* in North Bessarabia (Hotin Department).

(7) The *Turnu-Severin depôt* in Oltenia (Mehedintzi Department).

(8) The *Homorod depôt* in Transylvania (Tarnava Mare Department).

(9) The *Fagarass Sâmbata depôt* adjoining the stud farm of the same name and under the same administration.

(10) The *Partza depôt* adjoining the stud farm of the same name and under the same administration.

The total number of stallions in all the depôts is 1250, of the following breeds: Arab thoroughbred, English thoroughbred, Arab half-bred, English half-bred, Gidran, Nonius, Lipitzan, Hutzul, some Ardennese and Percherons, Oldemburg, American trotters and Orloffs. The most numerous are the Nonius (total 400).

Approved Stallions. In Roumania there is only a single category of privately-owned stallions allowed to be used for public breeding (no distinction is made between approved, authorised and accepted stallions). In 1924 they numbered 1600.

National Cattle Breeding. The State possesses the following national breeding stations for cattle:

(1) The *Roncu Station*, situated in a mountainous region of the Carpathians in Wallachia (Dambovitza Department) for the *brown Swiss* breed. The bulls produced here are distributed among the communes of the mountain regions. It is a small station with 15 cows and 2 bulls.

(2) The *Rousetzu Station* for the *Simmenthal* breed, situated in a steppe region adjoining the stud farm of the same name and under the same administration. It contains 24 breeding cows and 5 bulls.

(3) The *Popautzi Station*, in North Moldavia (Botassani Department) for the autochthonous breed, Moldavian variety, has 38 breeding cows and 3 bulls.

National Sheep Runs. The national sheep runs of Roumania, of which the last three are still in process of formation, are:

(1) The *Pallas sheep farm*, in Dobruja, with an area of 650 ha, where the *Rambouillet merinoes* are bred; it possesses 240 ewes and 10 rams.

(2) The *Brebeni sheep farm* in Wallachia, in the Olt Valley, with an area of 1450 ha., for the *early-maturing merino*: 300 ewes and 15 rams.

(3) The *Dulbanou sheep farm* in Wallachia, with an area of 400 ha., in the plain region (Buzeu Department) for the Karacul breed, with 120 ewes and 5 rams.

(4) The *Domitza sheep farm* also in Wallachia, in the plain region (R-Sarat Department) for the autochthonous Tzigaia breed, with an area of 1160 ha., and which is now being organised.

Swine-Breeding stations. These are installed near the different stud-farms and depôts already mentioned. They are of small size.

Public Loans free of interest. — Besides the breeding stock placed at the disposal of the public in the State depôts and distributed at reduced prices to the Communes and private persons, the State also grants the Communes loans without interest for acquiring *Communal breeding stock* consisting of bulls, boars and rams (but not stallions). A sum of 100,000,000 leis has been allotted for this purpose by a special law. With the aid of sums taken from this fund more than 100 Simmenthal and Schwyz bulls were imported from Switzerland in 1924.

B. — Indirect State Aid. — This takes the form of various prizes, grants, etc. The stock breeding commissions organise livestock shows in each Department; the State contributes thereto by sums entrusted to these commissions, as well as by awarding medals and diplomas. In the larger Departments, where breeding is more intense, similar shows are also organised in the departmental districts also with the intervention of the stock breeding commissions. Besides these local exhibitions, larger exhibitions are organized from time to time for a whole Province. In 1923 one such was organised at Jassy for Moldavia, Bucovina and Bessarabia. In 1924 the Exhibition for Transylvania and the Banat took place at Cluj. For 1925 an Exhibition is being organised at Timisoara for the Banat only and another at Kisinau for Bessarabia.

Private initiative.

There are few stock breeding associations in Roumania.

There is a limited number of associations, but they are not organised like true, specific, breeding associations for improving a certain breed, basing on the pedigree register, but are rather associations of a general character with numerous objects in view.

The studbook of the English thoroughbred is kept by the Jockey Club, whose headquarters are at Bucharest. The Society for the Encouragement of Half-Breds at Braila has a studbook for the half-bred. The studbook for the trotter is kept by the National Society for the Encouragement of Horsebreeding (S.N.I.C.).

Finally, for the Simmenthal breed of cattle, the Brasse (Transylvania) Syndicate has a Herd-Book.

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HEREDITY IN THE MULE.

How should the hereditary characters of the mule be interpreted ? This is a question we have treated in a preliminary way, in previous articles (1), by the aid of measurements taken during the war in the 1st Regiment of Mountain Artillery, of mules of various origin.

Our observations were necessarily incomplete for we did not know anything as to the forebears of the animals examined, a blank remained to be filled in, which has now been done thanks to the grant furnished by the " Fondation Loutreuil ". The grant has enabled us to study on the spot the Poitou mules and those of the Setif region in Algeria.

Before commencing to study the characters of the mule we must first examine those of its forebears, the asses and mares utilised in its production ; it will thus be easier to prove that if these hybrids have certain essential traits of resemblance, they nevertheless show a rather great comparative variability, resulting from the way in which the characters of either parent fuse or are placed in juxtaposition : *everything depends on the breeds of asses and mares brought together.*

I. The Poitou Ass.

The Poitou ass, which now has a worldwide reputation, is said to have been first imported into Spain by the Moors, and from thence introduced into the South of France via the Gulf of Gascony, or into Poitou through the small ports of the Vendée.

This hypothesis, which is taken from Ayrault (2) and is admitted by certain authors, is however only of secondary interest. From whatever part the ass was imported into Poitou, it must be observed that in this region — and for some time back — the finest animals are met with, which, with the Poitou mare, are capable of producing the most highly valued mules.

Averaging 1.44 m. high, in exceptional cases reaching 1.32 to

1.50 m. (3), the Poitou ass is remarkable for its large head with its wide flat forehead ; the orbital arches are widely separated from each other ; though prominent, it was not found that they give the animal a sombre and crafty appearance, as many authors have asserted ; though the eye is small, it is quick in movement.

The ears are wide, long, almost always well poised, standing above the head and bordered by long curling hairs known as "*Cadenettes*".

Under the lower jaws there are sometimes long hairs, forming a peculiar setting to the lower part of the head.

The neck is strong, short and furnished with a mane sufficiently long to hang down on the side.

The withers are not prominent and the lumbar-dorsal line is straight.

The longer the body, the higher are the asses valued for mule production ; the crupper is short, not wide, and the tail furnished with a small quantity of hair only at its extremity.

The breast is rather wide but is lacking in depth.

The shoulder is short and the foreleg also, and the latter is not thick ; the joints of the knees and hocks are as wide as in draught horses, and the shins are strong. When the hair on the lower part of the limbs, at the height of the fetlocks, is abundant, and that on the crown forms locks, covering part of the hoof, the animals are called "well heeled" ("bien talonnés, bien moustachés").

The coat is black or brown-bay ; in the latter case the lower part of the body is covered with white hair, extending and thinning out to the flat of the thighs.

The periphery of the mouth, nose and eyes is grey-white in colour ; the eyes are sometimes surrounded by a reddish aureole, which is lost in the deeper hair of the coat.

The asses belonging to certain owners are never groomed, and so the body hair becomes long and waved, forming fringed tufts of unequal length, somewhat resembling rags ; hence the name "*ragged*" given to these animals.

When well brushed they no longer have this peculiar hirsute aspect and the hair becomes short, as we have observed in some animals.

The attitude of the Poitou ass in nowise resembles that of the ordinary ass ; it is curious to see it, on leaving the stall, raise its head, prick its ears, advance at a trot and give a kind of plaintive bray.

The Poitou ass, though isolated the greater part of the time, is well fed; it is subjected to no ill-treatment, its only function being reproduction. Whereas the domestic ass, which, when it has reached an adult age, is often badly cared for, ill fed, beaten and overworked, and then has a sad air and seems resigned to its lot.

II. African Asses.

In Algiers several breeds of asses are used for mule production.

The native, as Trouette writes (4), pays no attention to the choice of the mare nor has any discernment in that of the ass.

"The Algerian ass, utilised as a stallion, varies in height from 1.15 to 1.30 m.; its skeleton is slender, joints narrow, hair not long, muscular masses dense and tendons well tempered".

It is rather larger than the ordinary ass and has a black coat which becomes light over the belly. The price before the war was 150 to 200 francs.

The ass while serving is led from market to market; in an out-of-the-way corner its master couples it with as many mares as may be brought up, sometimes eight or ten in the same day (5). It is not surprising that after three or four months of this treatment the animal is exhausted and that at the end of the season its mounts are less fecund than at the beginning, as Trouette points out. The farmers engaged in the mule industry mostly utilise for their mares asses imported from the Balearics, Catalonia, the Pyrenees or Savoy.

"The latter, smaller than the Poitou asses, become better acclimatised in warm regions, their price is lower and they produce sufficiently good results".

In the Setif districts, where mule production is very flourishing, for this region is tending to become "the Algerian Poitou", there are, in addition to the 180 native asses, 1 Poitou ass, 3 from the Pyrenees, 16 from Savoy, which have been imported through the care of the Committee. In this region there are also animals springing from former Spanish crossings, made with a view to increased size.

The Catalonian ass is tall, long in the limb, with a narrow, slender, well shaped body; its neck is long and crupper narrow. The coat is short, fine, glossy and soft to the touch.

Trouette reports that recourse might perhaps be had to the Sahara and Egyptian asses.

The finest specimens of the first attain 1.25 m. in height.

PLATE XC.

FIG. 244.—Poitou ass.

FIG. 245.—Algerian ass.

FIG. [illegible].—Pyrenean ass.

FIG. [illegible].—[illegible]rbera mare

PLATE XCI.

FIG. 248.—Brittany mare.

FIG. 249.—Stallion.

FIG. 250.—Poitou mare.

The Eyptian asses are 1.35 to 1.40 m. high, of ample body and rounded contour ; they are both compact and elegant in form. These animals, living in warmer climates than that of Algeria, may be acclimatised with less risk, especially as their requirements in feed are rather restricted.

The attempt would not be costly and deserves a trial (TROUETTE), " since the price of these animals is one tenth of that of the Poitou and Gascony asses introduced in the Setif region ".

In Algeria, stallion asses are under special supervision, with a view to prevent the propagation of dourine (General Government Decree, 4 March 1906). Further, a General State Decree (19 January 1907) was passed in order to combat the transmission of diseases such as : roaring, periodical fever and hereditary bone disease.

These measures are insufficient ; in TROUETTE's opinion " it would be well also to require that the perimeter of the thorax of asses should be of minimum size, the shin also ; and to leave it to the sanitary veterinary officials, or to special commissions, to judge as to form and within what limits service should be allowed or refused.

" In this way, by barring from reproduction a considerable number of valueless stallions, a production which is becoming more and more important every day, would be greatly imprvoed ".

III. MEASUREMENTS.

A. Head — Neck — Trunk — Crupper. As is known, in the horse, the length of the head is three times its width taken immediately below the eyes ; now, if from the measurements obtained by us we deduct, for Poitou animals, 2 to 3 cm. to allow for the excess resulting from the fact that the width was taken by us between the extreme points, i. e. from one orbit to the other, the length is still less than three times the width (6). In Algerian asses the head is smaller ; in fact it is of normal size if we take into account the excess above mentioned.

The cephalic index is higher in the Poitou ass, which is brachycephalic, as pointed out by SANSON, whereas the African ass is dolichocephalic.

The width of the head is twice the length ; here again it is seen that the head of the Poitou ass is generally broader, though in certain animals we found it of normal proportions. Generally speaking, the head of the Poitou ass is larger than that of the asses

examined in Algeria, which have a narrower, finer and less heavy head.

The length of the head is never equal to 2 ½ times the height of the withers ; the proportion between these two dimensions varies from a maximum of 2.4 in the Spanish ass to a minimum of 2.1 in the Poitou ass, and averages 2.2 (7).

The same applies to the scapulo-ischial length, which is always less than 2 ½ heads ; here however the average proportion seems to be rather higher, 2.3 ; in many animals it reaches 2.4. The length of the ass's ears is always greater than that of half the head ; this is a true character in the Poitou asses, in which we obtained an average percentage, as compared with the length of the head, of 55.5, with a minimum of 49.2 and a maximum of 56.4.

In the Algerian asses examined the percentage was 48, 49 and 50.8. These therefore have shorter ears ; we had already observed this character (8).

The ass has a short neck, 10 cm. less than the length of the head on an average, except in the case of a Spanish ass, in which it was found that the neck (60 cm.) was equal to a head (61 cm.).

The relation between the height of the chest and that of the saddle girth from the ground shows that the first is on an average less than a head in Poitou asses, but sometimes more by 1 to 2 cm.

The height of the chest in the African and Spanish asses is respectively about 1 1/8 and 1 1/15 of a head. The distance from the saddle girths to the ground is : about 1 1/3 heads for the Poitou ass, 1 1/8 for the African and 1 1/5 for the Spanish.

Generally speaking this dimension is greater than that met with in the mare and mule. The crupper is shorter than in the horse ; instead of measuring 5/6 of a head it varies from 2/3 to 3/4 of a head in the Poitou and African ass, 4/5 of a head in the Spanish and 3/4 in the Pyrenean ass. The width was equal to or less than the length.

In all of them, the scapulo-ilial length is more than a head.

We observed that it was, 1 1/7 head in the Poitou ass, 1 1/14 in the African, 1 1/5 in the Spanish, 1 1/4 in the Pyrenean.

It is known that this last dimension — measured from the upper-rear angle of the scapula to the external angle of the hip — is dependent on the inclination of the shoulder and the shortness of the crupper ; in the ass the crupper is short and the shoulder straight, hence this lengthening of the dorso-lumbary region, generally observed in the majority of animals.

B. *Fore and Hind Limbs.*

(*a*) Foreleg :

(1) *Poitou ass :* On an average the *shoulder* is shorter than the head by 9 cm., with variations of 10 to 7 cm. ; it is equal to about $^7/_8$ of a head.

The *upper foreleg* is very short, averaging $^5/_9$ of a head.

The *lower foreleg,* from the tip of the elbow to the super-carpal is about $^2/_3$ of a head.

The *length of the shin* (from the super-carpal bone to the spur) is rather more than half the head.

The *metacarpo-digital region* (from the super-carpal bone to the ground) is $^3/_4$ of a head.

The *shin* is shorter than the *foreleg.*

The *foreleg* is shorter than the *metacarpo-digital region.*

(2) *The African, Spanish and Pyrenean ass.* The length of the *shoulder* in the Spanish ass is less than that of the head by 4 cm. ; in the two others it is respectively about $^5/_6$ and $^6/_7$ of a head.

The *upper foreleg* is $^5/_9$ of a head in the African ass and $^3/_5$ in the Spanish and Pyrenean ; it is therefore rather longer in the two latter.

The *lower foreleg* is about $^2/_3$ of a head, in some cases rather above or below.

Though the *shin* is half the length of the head in the African ass, it is decidedly longer in the two others and more than half the length of the head by several cm. The *metacarpo-digital* region is equal (1 cm. more) to the lower foreleg in the African ass ; in the other two it is about ¼ of a head, and therefore longer than the antebrachial region.

Hindleg. In the Poitou and Algerian asses, as distinct from the Pyrenean ass and some Poitou asses, in which the patella is equidistant from the point of the rump and the outside angle of the ilium, the patella is generally nearer the ischial tuberosity than the hip ; this is very marked in the Spanish ass, in which a depressed crupper was combined with a more prominent thigh ; in these two species few animals showed a length of $^5/_6$ of a head ; the average was [illegible] of a head ; they are therefore shorter in proportion to the horse.

The distance from the patella to the point of the hock, is near that from the ischial tip to the patella in the African and Pyrenean asses. In the Spanish ass it is more than 10 cm.

The distance from the point of the hock to the spur is governed by nearly the same conditions as the preceding.

In the Poitou asses, the distance from the patella to the point of the hock is greater than the other two dimensions; that from the point of the hock to the spur is slightly less than that from the point of the rump to the patella.

The distance from the point of the hock to the ground is equal to the head in the Spanish ass; in the other animals it is less than the length of the head by some centimetres (from 2 to 5).

On comparing certain lines of radiation in the fore and hind limbs we find:

(1) that the distance from the point of the hock to the ground is greater than that from the super-carpal bone to the ground;

(2) that the distance from the point of the hock to the spur is greater than that from the super-carpal bone to the spur;

(3) that the two distances from the tip of the elbow to the ground and from the patella to the ground, are often equal, and when not so, the latter is the greater.

C. *Indices.*

1. *Total Cephalic Index*: This index is the relation between the maximum breadth and length of the head, the latter being taken as 100.

As we have already observed above, this index is generally higher in the Poitou ass.

2. *Body Index.* — This is furnished by the relation between the scapulo-ischial length and the thoracic perimeter, taken as 100. The nearer the scapulo ischial length to the thoracic perimeter the higher is this index, and this is observed on the longitudinal lines. With the exception of two animals, in which the index was 86.8 and 87.5, all the others gave a proportion of above 90, and this figure is met with in the elongated forms.

3. *Thoracic index.* — This indicates the variations in the form of the breast, and is expressed by the relation between the greatest width of this region, measured with the aid of callipers at the most convex point of the ribs, and the height.

As is known, in the horse this index is 90 for heavy draught horses, 87 for average horses and 85 for those of elongated shape; in the ass, in which the ribs are short and rather flat, we obtained an average of

80.4 for Poitou asses ; the index however is higher in the Pyrenean ass (89.6) ; it is lower in the African and Spanish asses (76.9 and 75.8).

Exceptions were found in the case of the Poitou breed, in which the index reached 91.5 and 92.8.

4. *Pectoral Index. Height of the breast* (vide sub-sternal). — The minimum recommended in the horse is $^4/_5$. This proportion averages 74.4 or $^3/_4$ in the Poitou ass ; it however reaches $^4/_5$ in some animals of this race and $^1/_1$ in the African ass.

5. *Crupper Index.* Width, Length - the length being taken as 100. — The average index is 96.4 for the Poitou ass. It is lower in the Spanish and Pyrenean asses, and reaches 100 in the African ass. In small animals of this breed, of an average height of 0.95 m., we previously noticed that the crupper was rather often wider than it was long.

6. *Draught Index.* — This is furnished by the average of the chest measurements and of the width of the crupper, as compared with the height (or more exactly with the number of cm. over a metre). The formula is :

$$I = \frac{\frac{p + h}{2}}{T - 100}$$

in which p = chest, h = width of haunches and T = height in cm.

In the draught horse which should be broad in the breast and crupper, this index is of real value ; the best, that which suitably combines strength with speed, is 79.69 (9).

It may be said that in the ass, the draught index is not so important, but is given in order later to make comparison with the mule. It averages 95.0 in the Poitou ass.

7. *Dactylo-thoracic index.* — This is the relation between the perimeter of the shin and that of the thorax ; it may be expressed by the ratio : $\frac{d}{t}$ or $\frac{t}{d}$.

The ratio is higher in the Poitou ass, which has greatly developed shins.

Mares for Mule-breeding.

A. in *Algeria* : In most cases, writes Trouette, " only worn-out, defective animals are coupled with the ass. This by the way is

a means of utilising those of no value, which was formerly, and still is, suggested by the Remount Service, desirous of excluding from horse-breeding, defective mares ".

On comparing the Barbary and Poitou mares our colleague pointed out that : " more than any other mares in the world, the former are 'internally mule producers'; whereas, indeed, 10 Poitou mares produce only 5 mules, 10 of the small Barbary mares produce 7 ". Native and European methods of breeding should also be considered.

The native pays no attention to the choice of the mare ; " it is as God made it " (TROUETTE).

With Europeans, the mares are generally stronger, better set up and often less defective than those of the natives.

Besides their breeding functions, they take part in farm work ; the breeders therefore exercise more care in choosing their mule producers. Some have bought French mares, which they pair with imported asses.

While on this subject, without entering into questions which do not come within the scope of this article, we will simply mention that in TROUETTE's opinion, in Algeria the breeding of the mule of from 350 to 400 kg. is preferable ; he therefore advises not to insist on producing the equivalent of the Poitou mule — which would be difficult in many places — but only an animal of larger size, heavier body, and stronger than the present Algerian mule.

This result may be obtained "*by a careful selection of mares, the use of imported stallions, and scientific feeding*".

The French mares imported for mule production are mostly of Brittany breed. Mares produced by crossing the Brittany stallion with the Barbary mare are preferred for this purpose.

By absorption crossing, to the 3rd and 4th generation, animals are obtained which are remarkable for their size and weight, and are perfectly suitable for the mule industry.

B. *In Poitou.* Contrary to what takes place in Algeria, the Poitou mare is exclusively reserved for mule breeding ; this is its only function throughout its existence : the Poitou farmer only breeds horses when his mares cannot produce mules.

At all times the Poitou breeders have attributed great importance to the choice of the mare in mule breeding.

While retaining certain characters of the old Poitou breed, the present mule breeding mare has been modified by crossings with heavy

draught breeds, such as the Boulogne, Percheron, and especially the Brittany.

Of large size and developed muscular system, the Poitou mare has a long body, low breast, rounded flank and wide powerful crupper. The forelegs are remarkable for their length and muscle, the shins are short and thick, the hoofs broad and flat, which character is accentuated by the fact that these mares are rarely shod. Grey or black coats are most esteemed; the hair of the mane, tail and limbs is long and abundant.

The more abundant, long and thick the hair and the purer the breed of the animal, the more it impresses its individual character (on the offspring).

The Poitou mares have a long, broad, thick head, the length of which is less than 2 $^1/_2$ times the height to the withers; the proportion is greater when compared with the scapulo-ischial dimension; the Poitou mares, like those of Barbary, which we have measured, are greater in length than height, and a certain amount of importance is attributed to this character in Poitou in mule breeding.

The scapulo-ilial length, in the Barbary and Poitou mares, is always greater than the length of the head.

The ears are longer in the Poitou mares; the length varies from 31.8 to 26.1 % of the length of the head; the proportion is lower in Barbary mares, being 27.5 to 29.3 %.

The height of the chest is almost equal to the distance from the sternum to the ground; in the Poitou mares the breast is lower than in the Barbary mares; in both cases the sub-sternal hollow is much less than in the ass.

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The various indices lead to the following conclusions:

(1) *The cephalic index*; is greater in the Poitou mares.

(2) *The body index varies*; it averages 86.54 in the last named. In the Barbary mares it is higher; they consequently have a more elongated form.

(3) *The thoracic index* is greater in the Poitou mares.

(4) *The pectoral index* shows that in the last named the height of the breast is approximately the distance from the sternum to the ground; sometimes these two dimensions are equal; in one case the sub-sternum hollow was less than the height of the chest.

(5) *The crupper index.* The crupper is always broader than it is long, and very much so in the Poitou mares with their haunches wide apart.

(6) *The draught index*, very high in the last named, shows their value as draught animals.

(7) *The dactylothoracic index* is slightly higher in the Poitou mares.

MULES.

The various authors who have written about mules have not always given a true description of this hybrid.

Many attribute to it exclusively a greater number of asinine characters ; others consider the mule does not differ materially from the mare, apart from the characters regarding the ears, tail and hoofs (12). How are the paternal and maternal characters distributed ? It would be interesting to cite the chief opinions on this subject. BUFFON, when considering the mule, concludes that the sire gives the extremities (head, tail, limbs), the external characters (skin and hair), the organs of sense and temperament ; while the mother imparts height, the shape of the trunk, the internal organs, strength, variety and character.

According to ISIDORE GEOFFROY SAINT-HILAIRE, hybrids are not always in the proportion of half-and-half ; they are, nevertheless, always mixed, and even form true intermediate forms.

In this author's opinion there may be a more or less close fusion between the two original types, or, on the contrary, a simple mixing of these types by juxtaposition of characters taken from each of them.

ED. PERRIER and Dr. BROCA think that there is no constant and fixed rule which would enable one to foresee how the characters of hybrids are formed.

In some cases there are such differences that no theoretic data would enable one to foretell before the test.

In GRAGNIER's opinion (13) the mule takes after its sire in form and after its mother in body volume.

Hybrids, like half-breds, writes SANSON (14), are subject to the laws of heredity, everything depending on the power of hereditary transmission of the animals paired.

In mules, the paternal and maternal characters are distributed in greatly varying proportions, now some, now others predominating, while sometimes the proportions are almost equal.

FIG. 251.—Poitou mare.

FIG. 252.—Algerian mule.

FIG. [illegible].—Algerian mule.

FIG. 254.—Poitou mule.

Fig. 255. — Poitou mule.

Fig. 256. — Poitou mule.

Fig. 257. — Poitou mule.

In BARON's opinion (15) the contour of the mule is more asinine than horse-like. Mules, like the offspring of the stallion and she-ass, show rather considerable relative variability, resulting from the way in which the characters of the two parents fuse or are juxtaposed; everything depends on the breed of ass and horse employed.

CORNEVIN (16) writes as follows in his description of hybrids: "The conformation of hybrids must necessarily vary in proportion to the hereditary influence of sex, species, breed and atavism, allowance being made for surroundings and individuation.

"In the body taken as a whole, parts are sometimes met with which, being furnished in their entirety by one species, exist side by side with those brought by another species.

"Some mules have the head entirely asinine, and horses' hoofs, or vice versa.

"The dissimilarities of these hybrids especially concern the dimensions and carriage of the ears, and the shape of the hoofs; it seems that in these two respects the individual influence of the reproducers is greater than that of the species.

"If observations are carried out on a large number, one must admit that the majority of the hybrids of the same class have characters in common, they are of the same style of build and their framework is on the same plan. The struggle between the two specific heredities leads to an arrangement which, after allowing for individual heredities, follows general laws. This arrangement gives one the impression that one of the constituant species predominates. Thus, in its external characters, the mule gives one the impression that it takes after the ass more than the horse, the mulard more after the Barbary duck than the ordinary duck, and the caquard more after the pheasant than the hen".

In BAILLET's opinion (17) the species which appears to preponderate in the conformation, organisation and temperament of the product in the act of generation, is generally the species which has the most fixed characteristics.

In the pairing of a wild with a domestic species the former having retained all the attributes of the specific type, transmits most of its characters; with two domestic species, the product takes most after that one which has been least modified by domesticity, but though one of the two species predominates there is always a combination of a certain number of paternal and maternal characters.

In LESBRE's opinion (18) the mule takes after both its ascendants.

but generally more after the ass than the horse as regards its external characteristics, its conformation and structure.

This distribution did not seem to differ in either sex. " It should be noted ", says LESBRE, " that most of the conformation traits are mixed, but their fusion is very unequal : the amalgamation varies according to the characters, and also for the same character according to individuals ".

The union of two domesticated species gives dissimilar products because in themselves they possess no stable qualities.

" In the union of one of our domestic dogs ", writes SUCHELET (19), " with a wolf or jackal, we must not be surprised to meet with young ones of different types in the same litter, the dog having undergone numerous transformations. If asses and horses be paired, dissimilar mules may be expected, the horse and ass species having undergone great modifications from their original form and colour ".

Indeed, though in all mules there is a certain likeness in outward form, whatever the mares and asses they come from, they show numerous variations among themselves, as we noticed from the numerous measurements taken during the war, in Algeria, or in Poitou.

This must be interpreted not only as the influence of heredities brought into contact, but perhaps also these variations are the result of the interactions of the complex " *organism × environment* " (20).

The mule really has an asinine form made more evident by the length of its ears, shorter than those of the ass, longer than those of the horse.

This character alone is almost sufficient of itself to give it the aspect of the ass ; it is easy to change the physionomy of certain horses and mules by modifying the length of the ears, as may be seen from photographs 258 and 259.

Photograph 258 shows a troop mare with a large head, prominent orbital arches and the ears of which have been lengthened ; photograph 259, on the contrary, is that of a mule, the ears of which have been shortened. The mule takes after both its ascendents, and it cannot be denied that the mare has a very great influence on its conformation.

The Poitou breeders have already long attributed great importance to the choice of the mare. One should read how energetically BUJAULT protested in 1834 against a report to the Prefect from the Manager of the Saint Maixent stud, in which it had been proposed to replace the Poitou breed by the Norman.

FIG. 258.—Military mare with long ears.

FIG. 259. Mule with shortened ears.

"To make the Norman into a mule-producing breed is the purest folly", he says, "which has ever entered the head of a man. This breed will be called the Manager's breed!" (21).

Undoubtedly the Poitou mules, the reputation of which is universal, owe their form to full bodied mares, chosen for mule production.

Comparison between the Algerian and Poitou mules.

A. — Head, Neck, Trunk, Crupper. The Poitou mule as compared with the Algerian, has a longer, wider, heavier head, and long ears, which character it inherits from its two progenitors.

The head of the Algerian mule likewise in consequence, of hereditary influences, is, on the contrary, generally finer, on the whole, and often shows the sinuous or convex profile of the Barbary mare.

The average length of its ears in % of head is 38.7, while it attains 42 in the Poitou mule.

The neck of the Algerian mule shows variations in length which it is interesting to note; generally shorter than the head, we found it in some cases equal or longer.

It is not the same with the Poitou mule, in which the length of the neck was always less than that of the head by some centimetres, in the animals we examined.

The average difference between the length of the neck and that of the head is less in the Algerian — this being the result of inherited qualities.

The height to the withers and the scapulo-ischial length give an average of 2.3 heads for the Poitou mule and 2.4 heads for the Algerian, this depending on the length of the head, which is greater in the former.

The scapulo-ilial length is greater in both cases than that of the head by some centimetres, a character which is found in the progenitors, often more accentuated in the ass and the Poitou mare.

The height of the breast is equal to $1\,{}^1/_{10}$ heads for the Algerian mule, and $1\,{}^1/_{15}$ heads for the Poitou mule.

The difference between the last named dimension and the distance from the sternum to the ground is: $79.7 - 67 = 12.7$ for the former, and $85.4 - 71.1 = 14.3$ for the latter; we find a sub-sternal hollow less than that of the ass and greatly superior to that of the mare, especially in the Poitou mules.

The crupper in the Algerian mule is often longer than it is wide; on the whole these two dimensions are almost equal.

In the Poitou mule the width is always greater than the length, which character it takes from its mother, the Poitou mare, with her broad and powerful crupper.

The Algerian mules from Brittany mares or half-breds are slightly wider in the crupper, as we noticed in certain animals.

The sex of mules, of Algerian mules at least, seems to have no influence in this matter, the number of males with a broader or narrower crupper being almost equal to that of the females.

In the Algerian mule, the length and breadth of the crupper is about $^{3}/_{4}$ of the head in the case of the Poiton mule, the length is nearly $^{3}/_{4}$ of the head, and the width $^{5}/_{6}$.

B. *Fore and hind limbs.* (a) *Fore limb. Shoulder.* — The length of the shoulder is, on an average, in both cases, less than that of the head, but though the difference is very small in the Algerian mule, it is rather more in the Poitou mule.

The shoulder of Algerian mules is often as long as the head, that of Poitou mules is shorter than the head by from 2 to 10 cm.

Foreleg. — (*a*) The Algerian mule: its length varies from $^{2}/_{5}$ to $^{2}/_{3}$ of the head. (*b*) The Poitou mule: the foreleg is about $^{3}/_{5}$ of a head.

Foreleg, shin, metacarpo-digital region. As we had already noticed, the antibrachial region has always proved shorter than the metacarpo-digital region. The difference is 5.85 in the Algerian mule and 4.4 in the Poitou. The latter therefore has a longer foreleg.

The height being taken as 100, the metacarpo-digital region is 4.4 cm. longer than the foreleg in the Algerian mule and 2.8 in the Poitou.

These regions as compared with the length of the head are:

	Algerian mule	Poitou mule
Foreleg	$^{2}/_{3}$ of head	$^{3}/_{4}$ of head
Metacarpo-digital region	$^{4}/_{5}$ „	*id.*

The shin region exceeds half the length of the head by 2.95 cm. in the Algerian mule and 3 cm. in the Poitou.

(b) *Hind limb.* — The distance from the point of the rump to the patella and that from the hip to the patella, differ but slightly in the Algerian mule, which is a good sign for the construction of the hind limb. The length of these two lines is about $^{4}/_{5}$ of a head.

The distance from the patella to the point of the hock is about [illegible]/4 of a head.

We found the distance from the point of the hock to the ground in individual cases, greater, equal to, or less than a head; on an average, it is slightly less.

In the Poitou mule the patella is farther from the hip than from the ischial tuberosity, i. e. it has a more depressed crupper, or a vertical thigh.

The same thing, by the way, is found in its two progenitors.

The distance from the point of the rump to the patella is about $^3/_4$ of a head. That from the hip to the patella is about $^4/_5$ of a head.

The distance from the patella to the point of the hock is greater than that observed in the Algerian mule, for it is nearly a head.

The distance from the point of the hock to the ground is on an average slightly less than a head.

In both cases, the distance from the point of the hock to the spur is nearly that from the point of the rump to the patella.

These various measurements of the hind limb are very variable in the mule, approaching those now of the horse, now of the ass, and often intermediary between the two.

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If we compare the distances from the point of the elbow to the ground and from the patella to the ground in the Algerian and Poitou mules, we find that the difference is greater in the former than in the latter in which these two dimensions are nearly equivalent.

Expressed in head length, we obtain the following proportions:

	Point of the elbow to the ground	Patella to the ground
(*a*) Algerian mule	1 $^1/_2$ heads	1 $^2/_5$ to 1 $^3/_5$ heads
(*b*) Poitou mule	1 $^2/_5$ to 1 $^3/_5$ heads	*id.*

The difference between the distance from the point of the elbow to the ground and that from the sternum to the ground is greater by some cm. in the Poitou mule. Its elbow is higher up on the breast ribs.

C. THE INDICES. 1. — The total *cephalic index* is higher in the Poitou mule: we have seen indeed that the latter has a broader head than the Algerian mule.

2. — The *body index* again is greater in the Poitou mule ; when above 90 it indicates a longilineal animal. There are numerous variations in the Algerian mule ; the average is 89.26.

Only in one case did we find a body index equal to 83.8, in a mule showing a very developed thoracic perimeter, prominent withers, a high breast, flat ribs and scapulo-ischial length less than the height to the withers.

3. — *The thoracic index.* That this is low in the mule is due to the fact that its breast is generally elliptic and its flank rather flat, which character it takes from its sire the ass.

The shape of the breast indeed has a considerable influence on the value of the thoracic index, which may be low in animals comparatively short, but with an elliptic breast.

On the other hand, the thoracic index was very high in two African mules, one from a Brittany mare, the other from a Barbary mare, with broad breast and rounded ribs.

4. — *The pectoral index* is 84.37 in the African mule and 83.25 in the Poitou, or $^5/_6$ in either case.

5. — *The draught index,* which we determined only in the Poitou mule, shows that this animal is excellently formed for draught work ; on an average it attains to 83.67.

6. — *The crupper index* is higher in the Poitou mule, in which we always found the crupper wider than it was long.

7. — *The dactylo-thoracic index* is slightly higher in the Poitou mule, the shins of which are more developed than those of the Algerian mules.

In the body index, the mule is nearer the ass ; in the others it is mostly nearer the horse, or intermediary between the two reproducers.

D. — Examination of general conformation. — On the whole, the following description may be applied to these two mules :

" The Algerian mule ", writes H. Geoffroy St. Hilaire, varies, from 1.30 m. to 1.50 m. in height ; some are small, lean and curtailed others are near the ground, thick set and of good muscular development ; certain of them are large and full-bodied : all these characters vary according to the different animals used in a system of breeding which, though not despised by the natives, is not based on such exact principles for improvement as are adopted in horse-breeding.

Geographic and food factors play an important part in the more or less extended development of these valuable animals (22).

The characters we have observed in the mules from the Setif region may be summarised thus :

The majority of the mules out of Barbary mares have a long thin head, narrow at the lower extremity ; the profile varies, and is mostly straight, but rather frequently sinuous and convex, the forehead is flat or slightly convex, the orbital arches generally are not very prominent, the eyes large and expressive and the ears comparatively short and rarely drooping.

The neck stands out well and is thin, the hair of the mane abundant, that of the tail less so, the crupper is narrow, short and flattened, as in the Barb, and the breast is well developed and deep.

The limbs are generally rather slender ; the shoulder is long in most cases, the forelegs rather short, the shins wide with well-detached tendons ; the fore-hoofs are rather rounded and the hind ones often nearly like those of the horse (23).

The skin is supple and fine, with short, fine hair.

Of 27 animals examined by us, 19 had 4 warty growths, a proportion of 70.3 %.

The Algerian mules bred around the tent, " douar " or farms, in complete liberty, are generally very mild, and we had no difficulty in taking the various measurements we needed.

Mules coming from Brittany mares generally appear more thickset and lower; the neck is shorter and more massive, the limbs are generally stronger in the shins and joints, the flank rounder, the breast broader, and the crupper broader and less flattened.

The Poitou mule may be considered as the draught mule " par excellence " ; it averages 1.56 m. in height and is sometimes as much as 1.60 m. or even more.

The head is powerful, with a straight profile, sometimes slightly convex at the base of the forehead, the lips are sometimes thick, the prominence of the orbital arches varies and is often but slight ; the ears are longer and wider than those of the Algerian mule ; the neck is strong and furnished with an abundant mane and forelock ; the withers stand out well, without being prominent, the back is straight and well supported, the breast high and the flank sometimes lacks rotundity ; the crupper is short, muscular and frequently rounded ; the hair of the tail is abundant.

The limbs on the whole are well developed ; the shoulder is short, the forelegs shorter than the metacarpo-digital region ; the shins

are strong and the joints of the knee, hock and fetlock broad and strong.

The fore-hoofs are slightly rounded and the hind-hoofs often nearly like those of the horse.

Of 7 mules which we measured, 5 had 4 warty growths. Generally speaking, the mule shows the greatest faults of conformation principally in the hind quarters; the crupper is often short and hollow, the haunches sloping, the thighs lean, and the hind limbs angular.

The conformation of mules greatly varies, and no one description can be applied to them: not one only but many mules differ from one another greatly, according to their origin; this is a matter of true heredity in their case, as in that of animals resulting from crossing different races.

It is an exaggeration to say that all mules have a heavy, bulky head, prominent orbital arches, a more or less sharply ridged back and a hollow or "mule" crupper. Having had the opportunity of measuring mules, as well as their sires and mothers, we noted that the distribution of characters is in the following proportion:

Distribution of characters of the ass and horse.

	Characters of ass %	Characters of horse %	Intermediary characters %
A. She mule from an African ass and a Barbary mare	37	22	40
B. Mule from a Pyrenean ass and a Brittany mare	28.5	28.5	42
C. Mule from the same ass and a Barbary mare	24.3	40.5	35.1
D. She mule from a Poitou ass and mare	20.9	34.8	44.1
E. Mule from a Poitou ass and mare. .	23.5	35.2	41.1
F. She mule from the same ass and a Poitou mare	12.1	57.5	30.3

Conclusions.

From the numerous measurements we have taken, both on mules and their ascendents, it may be concluded that the distribution of paternal or maternal characters in these hybrids shows very great variability.

It should nevertheless be observed that the intermediary charac-

ters resulting from the fusion are always stronger than those received from the ass.

In the Poitou mules, the characters received from the mares predominate, sometimes in a very evident manner ; the same is true in some cases with Algerian mules ; the greatest care therefore should be taken in choosing the mare for mule production.

The hereditary phenomena, whether it is a case of crossing breeds or species, are similar ; the offspring always takes after both its ascendents, in varied proportions.

Though the mule's extremities (head, hoofs) recall those of the ass, rather than the horse, they show numerous variations ; the ears, for instance, differ greatly in length, sometimes approaching those of the ass, though always shorter, sometimes those of the mare, though always longer. The same applies to the hairs of the mane, and even the hoofs.

Both sexes, as shown by SANSON in numerous examples taken from among half-breds or hybrids, have at first an equal hereditary influence on their offspring.

" Variations depend on the individual hereditary power, which is no more inherent in one sex than in the other, and concerns no portion of the body in particular " (24).

To understand the mechanism of heredity well, writes ETIENNE RABAUD, the nature of the living substance should first be known (25).

" The nucleus and cellular body forming one whole, constitute an association of proteic or other colloids and electrolytic solutions. In this association the factors are neither autonomous nor independent ; they are in close relation with one another, and *form a complex unit of which all the components influence one another reciprocally* ". These different component parts of living matter have been denominated by DANTEC " *plastic substances* ".

According to E. RABAUD, when the spermatozoid penetrates into the ovary, reactions which are by no means always of the same intensity are produced by the union of these two substances.

This interaction of substances is not the only factor.

" The egg proceeds to make exchanges with the surroundings in which it lives, it takes some materials and rejects others ; all evidence points to the fact that the actions exercised by these surroundings on the plastic substance modify their activity and consequently their interaction ".

When the organisms are closely related, as happens in animals of

the same pure breeds, their complexes contain similar plastic substances, and consequently bring about very analagous conditions. In the union of heterogenous organic complexes, like those of individuals of different species or races, the results are quite different.

" Some in relation with others form entirely new surroundings, and the different plastic substances no longer produce the same effects ".

This action of the organic complex, according to the number and nature of the plastic substances which compose it, is not a true hypothesis, but the application of the most recent knowledge acquired on the constitution of living matter (26).

In this connexion, the works by MAYER and SCHOEFFER (27) on " *the cellular constants* ", cited by RABAUD, constitute valuable arguments in favour of the physico-chemical theory of heredity. We should be going beyond the scope of our work if we entered further into the question of the mechanism of heredity, but we desired to draw attention to " the physico-chemical theory " of E. RABAUD, which is based on facts, and which, in our humble opinion, permits of a better interpretation of heredity in the mule.

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STATE OF THE CEREAL CROPS AND TRADE IN ROUMANIA.

Roumania is generally known as a country which has always been agricultural ; we may however more properly term it a " cerealist country ".

After the world war, the realisation of the union of all the Roumanian provinces into a single kingdom also brought in Transylvania and Banat, two provinces of appreciable industrial activity, and the idea has become general abroad, and even in Roumania, that Great Roumania will no longer henceforth occupy its former important position in the world's trade in cereals. This opinion, which is very erroneous, as we shall show, is based on the following argument : Transylvania and Banat (the part which has come back to Roumania) are less suitable for cereal cultivation and, on the other hand, are larger consumers of cereals than was the Former Kingdom of Roumania.

These two reasons are the results of an altogether superficial examination of the question, in which, on the one hand, the decrease in the production of cereals in the above-mentioned provinces is exaggerated, and on the other, the increase in the power of consumption of the two provinces.

If the total cereal production of Great Roumania be considered, it must not be iorgotten that Bessarabia yields a very appreciable surplus.

The following figures will support this statement :

The production capacity of the chief cereals (wheat, rye, barley, oats and maize) according to the pre-war data, per province, is as follows :

	ha	tons
Transylvania, Banat, Crisana, Maramures and Bucovina	3 724 000	5 205 000
Bessarabia	2 361 000	2 822 000
Former Kingdom	5 665 000	6 033 000
Total	11 750 000	14 060 000

That is to say, the productive capacity of the various cereals has risen from 6 million tons in the Former Kingdom to 14 million tons in Great Roumania; consequently it has increased 2.33 times

The increase in total area has been	2.29	»
That of the population has been	2.16	»
That of the area under cereals has been	2.07	»

Consequently, as regards cereals, the proportions have remained the same in United Roumania as in pre-war Roumania.

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We have spoken up to the present of productive capacity, and not of production, and have taken the figures of the pre-war yield and not the present figures. The reason for doing so is that Roumania, in this respect, is at present in an abnormal state, and the present figures can only be of very relative value

In fact, after the war, a social-economic revolution has taken place in Roumania, pacific and without any sort of opposition, in which the lands of the large estates have been allotted, under certain conditions, to the peasants, and the large capitalist agricultural enterprises, with large means of all kinds, have thus been transformed into small enterprises, without capital and with primitive means. To this should also be added, besides a number of other factors, a series of years very unfavourable to agriculture, which have not played the least important part in bringing about the present abnormal situation.

Little by little all these unfavourable circumstances will be improved, because the peasant, having become a landowner, but without capital, will gather together the necessary material, will improve his equipment more and more and there will be better management and more scientific livestock breeding, which in turn will appreciably increase his capacity for soil cultivation.

Side by side with this gradual material improvement for the peasant, the progress following on instruction will be seen to penetrate automatically, for the Roumanian peasant is very amenable to instruction and progress.

The author of these lines speaks from experience, having had the opportunity of observing on the spot the admirable results following the settlements in Dobruja of purely Roumanian elemencs, almost all natives of the Former Kingdom, the Transylvanians

being in the minority and more especially sheep breeders, and a part coming from the southern provinces of Bessarabia, which passed in 1878 to Russia.

The Roumanian Government has not given to the Dobrujan settlers anything but the bare land, and they started work in extremely difficult conditions, for they were without houses, stabling, roads, railways, schools, churches and a great number of other things. Industry was altogether out of the question.

In less than twenty years the soil of Dobruja, considered unfit for cereal cultivation, has become an important grain centre, and the Roumanian villages have visibly increased and become richer; fine schools and churches are springing up here and there, and all this is owing to the sole initiative and means of the villagers themselves.

Similarly it may be concluded as certain that, in a short time Roumania will resume the place it has always held in the world's cereal market. And the country will increase in importance with the extension of its territory, and if we think that the land under cereals in Roumania may be still further considerably increased by the exploitation of the immense territories which can be irrigated along the Danube and at its delta, and add thereto a gradually increased yield (to-day it is below 15 hectolitres per ha., whereas England, Belgium, etc. have a yield of more than 32 hectolitres per ha.), the great development which will take place in the cultivation of cereals in Roumania may be easily imagined.

With regard to certain ideas of transforming this cultivation in Roumania, even supported by Roumanian statesmen, as for instance an increased cultivation of forage crops in view of the increase in stock breeding, the advantages should not be exaggerated, for in any case these changes can only very slightly influence the cultivation of cereals as regards their extension and intensification. The same may be said, without the risk of error, of the recent attempts to introduce the cultivation of cotton.

As regards the extended cultivation of oleaginous plants (rape and flax) and legumes (beans, peas and lentils) an increase in production will naturally take place, but rather slowly; on the other hand, from the commercial point of view, they come within the category of cereals and occupy a similar place on the market.

It has also been proposed, and attempts have even been made, after the war, to industrialise the country more and more, and it

has been thought that that would restrict the cultivation, or rather the exportation, of cereals

This idea must be excluded for a number of years to come, for of the mining industries, among which that of petrol may be more especially mentioned, the only ones capable of rapid development are not of a nature to greatly modify our cereal trade abroad.

At the present juncture of affairs in Roumania, cereals will form the wealth of the country and the preponderating part of foreign trade for a long time yet; it is therefore very natural that the organisation of the cereal trade with a view to promoting cultivation is engaging the serious attention of specialists in Roumania.

In this connection the first question which presents itself, and is of vital importance, is the question of transport.

The absolute lack of suitable railway transport, the railways being all owned and managed by the State, is a great obstacle to the profitable development of cereals in Roumania.

Moreover, the problem of railways is not new in Roumania, for even before the war, their insufficiency strongly reacted on the whole of the national economy of the country, and more especially on the cereal trade. The cause of this was that production and trade developed in geometrical progression, whereas the capacity for transport by rail scarcely followed in arithmetical progression.

Unfortunately this situation has become still worse after the war, for though production and trade have become greatly reduced, the railways, owing to lack of material after the war, have been, so to speak, annihilated. What has been done to improve railway transport is far below what is being done towards reestablishing production and trade. Thus, naturally, the unsatisfactory state continues.

The insufficiency of railways has been acutely felt from the end of the war up to the present time, in spite of the fact that production has considerably decreased and exportation been reduced in consequence.

What will happen when production becomes normal and, consequently, exportation also?

Some figures will enlighten us on this question:

The Former Kingdom exported on an average each year 3 300 000 tons of cereals out of its total production of 6 000 000 tons annually, i. e. 55 % (a proportion only equalled by that of Argentina, all other

countries in the world following well behind), while cereals formed 72 % of the total exports of the country.

Great Roumania, in 1923, exported 1 608 000 tons of cereals out of a total production of 9 745 000 tons, i. e. scarcely 17.5 %, and scarcely 35 % of the total exportation in 1923 (4 878 000 tons).

Taking the normal percentage of exports, namely 55 %, out of the total production of 14 million tons, we should export about 7,700,000 tons yearly.

How shall we transport all that, if it has been so difficult to transport scarcely 1 700 000 tons of cereals per year?

On the Danube, it may be said that things are a little better as regards water transport, though river tonnage was also reduced during the war, and has not yet been made good; at the present time on the Lower Danube there are about 600 000 tons of carrying capacity (lighter tonnage), and before the war this capacity was 942 000 tons; the present tonnage has proportionally even less tractive power than before the war, owing to the lack of tugs.

With such an insufficiency of transport, the necessity of means of warehousing cereals is naturally felt even more, and however great this capacity, it would always be insufficient so long as transport cannot be effected at the proper time.

Between the carrying capacity and warehouse capacity, there is a very close relation: one should aid and complete the other; but to do this with advantage, there must be a true equilibrium between these two factors. Any warehousing depôt system, however ideal, becomes disadvantageous or too expensive, or both, without suitable transport capacity; the investment of capital for bonded warehouses is very great, and, without active movement, cannot bring in any return, but movement without transport capacity cannot exist.

In recent years the Roumanian Government has taken up the question of cereal warehouses very seriously, examining the possibility of introducing the American system, with standardisation, grading and certification. The promoters of this suggestion and those who proposed it to the Government, have based on the principle that the introduction of the American system in Roumania would to a great extent solve the question of facilitating transport, saying that this would take place the same as in America.

The fact of their supporting this idea arises from exaggerating the effects of the system. In America the system has succeeded

owing to the great transport capacity, which has given the system that movement which alone can ensure returns on the capital invested without encumbering production too much with exaggerated storage.

The American systems, as regards constructional and mechanical technique, docks and elevators, have commenced to become general even in Europe, in the centres having an active trade in cereals, irrespective of whether it is a question of exportation, importation, or even of local trade; but the American system, as regards commercial technique, i. e. standardisation, grading and certification, has not been followed anywhere in Europe up to the present, for European conditions are totally different from American. The only thing in the way of trade technique coming from America and kept up in Europe is "warrantage", an operation quite independent of the rest of the system.

Moreover, the system of "warrantage" of cereals exists also in Roumania, has long existed even, in the principal ports where there are also stores with elevators on the American system, at Braila, Galatz and Constanza; but neither has the "warrantage" given the results hoped for in Roumania, because circumstances in our country are quite different from those in America.

Consequently, the present moment would not be suitable to try to introduce the system of American classification of cereals in Roumania, now that the means of transport are so unsatisfactory, and when it cannot be a question of classing trade qualities as formerly, under the large estate system, when each grows "what Providence sends", and Roumanian cereals are traded abroad almost exclusively on the basis of "fair average quality", or at most, on that of "types", i. e. of approximate samples, with a general character, previously established for the whole season.

This however does not mean that the intrinsic value of Roumanian cereals has in any way diminished, for this value is quite independent of the weight per hectolitre and the percentage of offal, which are only related to yield, and consequently form a question of commercial calculation. For instance, Roumanian wheat weighing 75 kg. per hectolitre may give a flour of superior quality to that given by another species of wheat weighing 80 kg. per hectolitre and without extraneous matter.

This, by the way, is still better known abroad than in Roumania, for the Roumanian cereals, light as they are and impure,

hold the first place in foreign ports, in comparison with the heavier and purer cereals from other parts.

Moreover, as regards the introduction of the American system of grading in Roumania, all competent and interested circles, farmers and dealers, are decidedly opposed to it.

It is to be hoped that the Roumanian Governments will inaugurate an economic and fiscal policy more favourable to the cultivation of cereals in the country, the only country which taxes its cereals for export to the extent of 25 to 35 % of their value within the country.

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INTERNATIONAL ASSOCIATIONS

PROCEEDINGS OF THE INTERNATIONAL SOCIETY OF SOIL SCIENCE

Papers.

On the question of KCl addition in the case of the electro-metric determination of the soil reaction. II:

CAN THE LIME-REQUIREMENTS OF THE SOIL BE DETERMINED FROM THE REACTION OF SOIL SUSPENSIONS CONTAINING POTASSIUM CHLORIDE?

In the *Internationalen Mitteilungen für Bodenkunde*, Vol. XIV, p. 137, 1924, I showed in collaboration with H. PFEFFER, that the DAIKUHARA method and the determination of the "real acidity" in suspensions containing KCl, in the case of mineral soils, give proportional values, because in such soils the real acidity is a function of the exchanged aluminium.

The comparison of the "titration acidity" of the soil extract in 1 m. of KCl solution with the electro-metric determination of the P_H of the soil suspension in 0.1 m. KCl solution, was undertaken in order to justify the theory of KAPPEN as to the importance of the "exchange acidity" which was attacked at the Rome Soil Science Congress in 1924.

KAPPEN himself and his colleague reject the determination of the exchange acidity by means of physical methods, because the P_H 'does not always fit in' to the correspondence between titrated "exchange-acidity" and growth of the cultivated plants.

Since H. KURSTE for example has measured the P_H in a water suspension, it is not surprising that he reaches the same conclusion as KAPPEN. "Titration-acidity" in KCl soil extracts and P_H va-

lues in water suspensions are incommessurable quantities. That the P_H values of the suspensions with KCl content actually do fit into the above mentioned relation between acidity and plant growth, has been shown by the author from copious material which was accumulated by means of soil researches carried out on farms in conjunction with practical farmers (2).

To obviate any misunderstanding it may here be once more emphasized that it is the electro-metric determination of the soil reaction that is in question; in colorimetric methods the addition of neutral salts is undoubtedly misleading on account of the likelihood of errors and should be avoided. If the objectors to the addition of KCl take their stand on the fact that the influence of the potassium chloride depends on the soil reaction from the concentration (3), they are overlooking in that connection:

1. that the natural suspension of soil in water is a water suspension only in name, as HAGER (4) has specially pointed out;

2. that onwards from a certain concentration the influence of the KCl is constant (5).

It is obvious that by the use of fertilisers containing potassium salts the concentration of 0.1 m. is not reached. But since it is precisely the very small KCl concentrations which have the most marked effect, and since, in consequence of the experimental method followed, employment of syphons filled with KCl, it is difficult to prevent the diffusion of KCl in the soil suspensions or even to control it, it seems to me to be practicable to select such a concentration (0.1 m KCl) which, on the one side yields constant maximum values and on the other has no marked effect in diminishing salts in the quinhydrone or hydrogen electrode.

My further researches make it possible to advance a step further and in the direction of the determination, or a closer estimate, of the 'lime-requirement' of the soil. If the electro-metric determinations of the soil suspensions on 0.1 m. KCl solution and the "total acidity' determined by titration in 1 m. KCl soil extracts are shown on a system of co-ordinates, a curve results which makes it possible to draw conclusions as to the lime requirements from the hydrogen index; the natural assumption therefore is that the total acidity as determined by the DAIKUHARA method is a measure of the lime requirement of the soil.

Loamy and clayey soils of a varying, but for the most part small humus content were employed for the comparative experiments.

The P_H determinations were obtained electrometrically on application of the acidimeter, which I have described on a previous occasion (6), to suspensions containing 0.1 m KCl. The "total acidity" was quite independently determined by Dr. UTESCHER and Dr. HALLER according to the DAIKUKARA method.

The following table gives the results of the comparative experiment, which is represented graphically in the diagram in the text:

The relation between P_H and the "total acidity" is shown by a series of curves (fig. 260), in which the curves become flatter as the

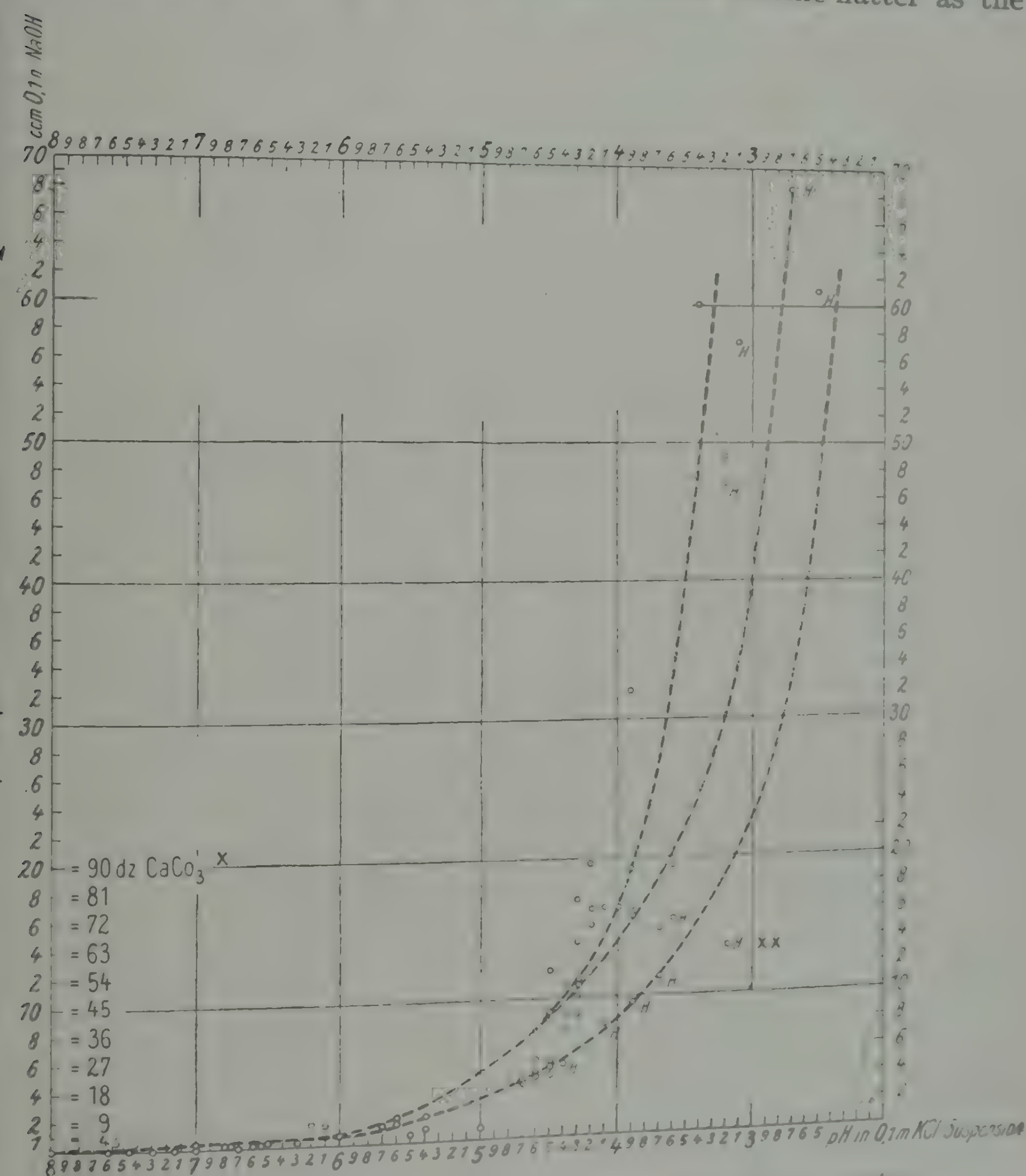

FIG. 260. — The dependence of the lime requirement on the soil reaction.
Explanations : x = Lime requirement per hectare.
xx — H = humus.

TABLE I. — *The Dependence of the Lime Requirement on the Soil Reaction.*

No.	Laboratory number	Actual acidity of the soil suspension P_H	Total acidity cc. 0,1 N. NaOH	Remarks
1	9 371	7.3	0.0	
2	8 373	7.0	0.0	
3	9 374	6.4	0.2	
4	9 369	7.15	0.0	
5	9 789	6.55	0.2	
6	9 860	7.45	0.0	Poor soil with 30 % $CaCO_3$.
7	9 861	7.61	0.0	
8	9 939	6.2	1.4	
9	9 940	6.1	1.3	Arable loam soil from the Oder marsh (Gieshof).
10	9 941	5.6	1.8	
11	9 942	5.4	1.5	
12	9 943	5.6	1.4	
13	9 944	5.4	1.9	
14	9 312	4.5	12.0	Sub-soil of forest soil.
15	9 315	4.3	17.2	
16	9 332	6.2	0.6	
17	9 334	6.4	0.4	
18	9 337	4.7	4.0	
19	9 992	6.6	0.0	Loan with 6 % $CaCO_3$.
20	10 019	6.7	0.0	
21	9 989	4.6	5.6	Humus clay.
22	9 990	4.4	10.4	
23	9 991	4.5	9.0	
24	9 993	6.5	0.0	Clay soils 6 % $CaCO_3$.
25	10 028 a	4.4	8.8	
26	(7) 10 028 b	4.8	4.7	Nos. 25-49 are loamy forest soils (7).
27	10 028 c	4.2	19.6	
28	10 029 a	4.3	10.0	
29	10 029 b	4.5	5.2	
30	10 029 c	4.2	16.4	
31	10 030 a	4.0	16.4	
32	10 030 b	4.4	4.4	
33	10 030 c	4.1	16.4	
34	10 031 a	4.0	16.4	
35	10 031 b	4.7	4.0	
36	10 031 c	4.3	14.0	
37	10 032 a	4.3	11.2	
38	10 032 b	4.3	1 .0	
39	10 033 a	4.2	8.0	
40	10 033 b	4.6	4.8	
41	10 033 c	4.2	15.2	
42	10 034 a	4.4	7.6	
43	10 034 b	3.9	19.2	
44	10 035 a	4.3	8.8	
45	10 035 b	4.5	5.2	
46	10 036 a	4.5	4.4	
47	10 036 b	4.5	4.4	
48	10 037 o	3.7	11.8	
49	10 037 b	4.4	5.2	

TABLE I. — *The Dependence of the Lime Requirement on the Soil Reaction.*

No.	Laboratory number	Actual acidity of the soil suspension P_H	Total acidity cc. 0.1 N. NaOH	Remarks
50	10 040	3.9	9 6	
51	10 041	3.2	14.4	
52	9 493	3.5	23.2	
53	9 436	3.6	19.4	
54	T 3	3.9	32.0	Tropical primitive forest soil.
55	9 429	3.2	57.2	Humous forest soil.
56	9 845	3.4	60.0	
57	9 635	3.6	15.6	Humous forest soil.
58	9 428	3.1	47.6	Humous forest soil.
59	9 712	5.0	0.8	
60	9 710	5.5	0.6	
61	9 432	5.7	1.2	
62	9 471	8.0	0.0	
63	9 799	3.7	14.4	
64	9 418	2.5	61.0	
65	9 419	2.7	68.4	
66	10 000	6.75	0.2	Loamy mould.
67	10 001	7.0	0.3	Subsoil at depth of 1 m.
68	10 002	6.0	0.7	Subsoil at depth of 2.2 m.
69	10 003	7.05	0.3	Subsoil at depth of 3.5 m.
70	10 025	6.5	0.4	
71	10 026	6.3	0.4	
72	10 027	6.8	0.2	
73	10 028	6.6	0.2	
74	10 029	6.5	0.2	

content of humus increases: the divergence is not great up to P_H 4.5. Since soils the reaction of which is more acid than P_H 4.5 are on the whole of rare occurrence, the steeper curve practically serves to determine the lime requirement from the quickly ascertainable value in P_H. In the case of obviously humous soils the flatter curve will be suitable for the purpose.

The lime requirement in kg. $CaCO_3$ on 1 hectare (3 million kg.) is reckoned according to the formula: $a \times 3 \times 1.5$ in which a is the titration liquid reckoned in cm. on 100 gm. soil. These figures hold for heavy soils: for medium soils the value should be estimated at about half and for sandy soils at one-third.

As the series of curves approaches the co-ordinates as asymptotes, the questions may be put: What lime requirement has a soil which is in the first place neutral, and in the second more acid than P_H 4.0? In both cases the curve seems to give no answer.

To this it may be replied: in the case of neutral soils the DAIKUHARA method must necessarily fail: a highly probable case is that in which a soil containing no chalk is agitated with KCL solution and shows no acidity that is capable of titration. In such cases other methods must be employed.

In the case of very acid soils the quantities of lime estimated as required according to DAIKUHARA are so large that it becomes impossible on practical grounds to supply the lime deficiency by a single liming.

From the above considerations the following conclusions seem able to be drawn:

1. If the soil is neutral, the lime content of the soil is to be tested either by analytical or geological methods, and accordingly a minimum dose given, the amount of which is to be determined empirically.

2. In the case of slightly acid soils the lime requirement can be determined approximately from the given series of curves; with markedly humous soils the flatter curve is employed for the purpose (8).

3. With soils that are more acid than P_H 4.0, the first thing to do is do apply the quantity of lime which is practically possible; after a certain time to ascertain the result by renewed testing and to make any further liming depend on these tests.

I wish here to thank Prof. Dr. SCHUCHT, Prof. GANSSEN and Dr. HELMERS for the valuable suggestions they have made.

SUMMARY.

In completion of earlier investigations in regard to the dependence of the P_H, from the " total acidity ", the attempt is made to infer the lime requirement of the soil from the P_H determination of the soil suspension in 0.1 m. KCl solution. The dependence of the lime requirement on the P_H is graphically represented: the curve of the humous soils is clearly distinguishable from that of the pure mineral soils and gives for humous soils a lower lime requirement than for mineral soils.

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(7) The soils marked *a* are drawn from humous mould ; those marked with *b* and *c* come from the subsoil.

(8) Th. Arndt. *Zeitschrift f. Pflanz. u. Düngung.* Section Year 4, pp. 55-72. Arndt states that the Daikuhara method gives too high a value for marshland soils.

TO WHAT EXTENT IS THE LIME CONTENT AND REACTION OF A SOIL RELATED TO THE MANNER OF ITS FORMATION?

The controversy as to how far we are justified in drawing conclusions as to the chemical and mechanical properties of a soil from the geological character of its subsoil, is as old as the science of agriculture itself. There were also two schools of thought as to the estimation of the lime-content of a soil from the character of the underlying matrix. One school believed in its general application, while the other denied it by putting forward generalisations which applied only to large areas.

From a geological standpoint, the principal objection which can be put forward against the derivation of the carbonate of lime content of a soil from its geological relation to the underlying matrix, is that, although this may be true in the case of primary soils, especially when the length of the weathering action on them is known, they occur in much smaller numbers than secondary soils. The above statement is also true, if we leave out of account, in the case of a large number of primary soils, the influence of climatic changes which have taken place, up to most recent times.

Agricultural science was able to prove in the course of the last decade (1) that starting with the same rock, different climatic conditions produce quite different soils, and that the following rule applies : in dry soils the bases remain, in humid soils they are washed out.

In the humid climatic regions therefore, all primary soils must either be deficient or get deficient in bases, or looking on it from a colloid-chemical point of view, they are, or are getting in an absorptive-unsaturated state, i. e. either have an acid reaction or are passing into acidity.

However, even a considerable number of secondary soils have been and still are undergoing an impoverishment in bases.

The base content of a soil is determined on the one hand by the base content of the original rocks, from which it was formed, and on the other hand by the time during which the varying climatic factors have been changing over the same region (2). But this statement loses considerably in its general applicability on

account of the far-reaching climatic changes which have taken place over the whole of our region during the diluvium, and the events since then. The upper layers of the primary soils in the humid climatic zone consist now of the further sub-aerial developments of the then (in diluvium) existing soils, together with the aeolithic and fluvial deposits of the ice-age. Equalising influences caused the prevalence, in this zone, of the brown-earth type, but it must be remembered that the duration of these influences is still too short to produce a chemically homogenous type of soil, especially in countries like Bavaria, where the multiplicity of the geological strata and the multiformity of the orographic arrangements and of their relations on a limited space is so very great. The equalising factors are influenced to a great extent by the mechanical composition of the soil.

In considering the strata, which, when looked upon from an agricultural and forestry point of view, we call soil, we must, among other factors, take account of the influence of plants and animals on it, and must also not forget the influence exerted by man through ploughing, manuring and choice of plants. Correspondingly, the deficiency of a soil in bases, will differ according as it is covered by plants, and it will depend on the kind of plant, whether its physical character will allow the earth-worm to exert its full action, and according as man by his ploughing mixes the layers of subsoil richer in bases, with the poorer upper layers, and according as he adds, through manuring, substances rich in bases, base-fixing or base-liberating.

The last mentioned point, of the chemical changes produced by manuring in the soil, has attracted the special attention of agricultural chemists in the last decade.

Fundamental researches, as *e.g.* those of R. GANS (3), explained the influence of different kinds of weathering on the molecular composition of the zeolithic silicates, and thus gave valuable insight into the nature of the reactions taking place in a soil. They showed that in considering the zeolithic silicates of the soil, decomposable by hydrochloric acid — the aluminium silicates — as chemical compounds, that a soil should be called *neutral*, whose zeolithic silicates are so composed that to each 3 mols. of SiO_2 and 1 mol. Al_2O_3 they contain 1 mol. of a base (CaO, MgO, K_2O, Na_2O), and those are to be considered *acidic* which contain to every 3 or more mols. of SiO_2 less than 1 mol. of a base, and if to every 3 mols.

SiO_2 there are more than 1 mol. Al_2O_3, they are to be considered *basic*.

On the results of these investigations were assumed to be based the numerous investigations on the chemical reactions taking place in agricultural soils, whose principal object was the elucidation of the changes produced in those soils by manuring. In all these investigations we are dealing with an object with a definite geological history, and that history left its mark on its chemical character and behaviour; and many a generalisation injurious to the science of manuring was retained in this way.

The use of artificial manures does not go far back, and in the case of Bavaria, certainly not more than a few decades, and the amounts used even now are comparatively small, and some soils did not get any artificial manuring until very recent times. They have in many cases a typical and very often an acid reaction. This may refer to heavy soils. On the other hand, there is at this Institute a large number of unfinished investigations on test-field loamy-soils, which have been receiving considerable amounts of chemically and physiologically acid manures for a number of years and which even now still show their unchanged original reaction. Thus, we have on the one side soils as. *e.g.*, the majority of sandy-soils poor in bases and many loamy-soils, which on addition of large amounts of chlorine-containing or physiologically acid-neutral salts begin to show an acid reaction, which makes them unsuitable for the economic growth of plants, but on the other side we have soils which on account of their geologically based physical and chemical constitution, not only favour prolonged acid manuring, without addition of bases, but even require it. In other words, when considering the chemical reactions of a soil the geological and agricultural aspects must not be omitted. True, in this way many a generalisation in manure-technique would have been missed, but on the other hand many geological and agricultural scientific experiences would have been gained, which would have formed a starting point for many generalisations which, though applicable only within certain limits, could yet be extended from single experimental results to all the geologically similar soils.

These general observations apply to a comparatively large number of systematic investigations on the reactions and lime requirements of most Bavarian soils, carried out at this Institute for agricultural chemistry, since 1923, after many years of prepa-

atory work. In the following pages it will be attempted to give account of certain of the results obtained, but before doing this, is will be useful to give an account of the procedure of the investigation, from the taking of the soil-sample up to the investigation proper (4).

The party chosen for supplying a soil-sample, for lime-requirement and chemical investigation, receives together with a guide as to the way the sample should be taken, also a questionnaire. The questions are put not only from a manure technical and plant-organisational point of view, but also from a geological and agricultural scientific point of view. The completed questionnaires are returned simultaneously with the soil-samples. Already first experiences have shown that large and small farmers alike answered the different questions very unreliably, and although, no doubt, the answers received do give some information, yet for statistical purposes even, quite disregarding scientific purposes, the material can be used only with great care, if at all. We therefore sought the collaboration of the Bavarian agricultural advisers, and in the course of the first year we managed to interest in our work 42 agricultural stations (5), to supply us with soil-samples for investigation and in most cases, to answer our questionnaire for each soil sample separately. Also in this case it was soon found that on the average the answers are suitable only for drawing of statistical conclusions, but only in few cases are they suitable for scientific use. In most cases special stress is laid on the manuring and plant-organisation answers, for quite obvious reasons, while the agricultural-scientific answers are unsatisfactory. It may be that the unsatisfactoriness of the geological and scientific-agricultural answers is due to the fact that they are given by men expecting immediate practical results, or it may be due no doubt in many cases, to the ignorance of the soil forming factors and of the disposition of the secondary geological strata, which ignorance cannot be dispelled because of the lack of suitable 1 : 25,000 maps.

After this was recognised, the reporter (F. V.) himself attempted to obtain, with the help of good geological maps, typical soil-samples from different parts of Bavaria, so as to get the necessary scientific basis for the conclusions drawn.

In this way only could the suspicion of a close relationship between the chemical character of a soil and its geological mode

of origin be confirmed. These observations will be given in the following pages.

Each sample received was registered, separated according to the size of its particles, and had to undergo a preliminary investigation by different quantitative methods (6). These preliminary investigations were carried out to gain information as to the general character of the chemical reactions of the sample. Next followed the measurement of its hydrogen-ion concentration, the institution of the nitrogen bacteria test, and, if necessary, the determination of its titrational acidity.

In the statistical treatment of the 2255 soil-samples received from September 1st 1923 till August 31st 1924 (7), after their arrangement in different reaction stages — according to the hydrogen-ion concentrations, P^H, as determined in KCl extract — the following were the results:

TABLE I.

PH reaction	No. of soils	% of the total
Below 4.5	283	12.55
4.5 — 5.0	263	11.68
5.01 — 5.6	175	7.67
5.61 — 6.2	410	11.18
6.21 — 6.7	342	15.16
6.71 — 7.0	281	12.46
Above 7.0	501	22.21

According to this, if we consider only the hydrogen-ion concentrations as measured in a KCl extract, more than half of all soils investigated (P^H below 4.5 up to P^H 6.2) namely 50.17 % may be regarded as physiologically acid, 15.16 % (P^H, 6.21-6.7) as neutral and 34.67 % (P^H 6.71 – over 7.0) as alkaline. Almost all soils with a P^H below 6.2 and a number of those with a P^H of 6.2 – 6.7 must on the results of other different investigations be regarded as deficient in lime. The great majority of soils of P^H 6.2 must be considered as absorptively – unsaturated.

The unexpectedly large number of Bavarian soils found to be acid and deficient in lime, caused us to investigate their relation to the different geological formations found in the country. This appeared necessary in view of the multiformity of the Bavarian

geology, if a general conclusion is going to be drawn, applicable to all the other numerous Bavarian soils, which, to form a final opinion, still required investigation, and if a conclusion is going to be drawn as to the distribution of the lime-deficient and non-deficient soils under investigation.

Investigations were therefore undertaken to determine the geological character of the different soils. For this purpose use was made of samples of soils taken from the Institute itself, and of samples of soils sent in, in exceptional cases, with satisfactorily answered questionnaires. These samples, well known, were then united into definite geological and scientific-agricultural groups. It was thus possible, *e.g.*, to separate out distinct groups from the large number of secondary groups forming a soil-group in a given formation, and this was possible in the case of lower-terrace loamy soils, upper-terrace loamy soils, certain diluvial loamy soils of Franconia, and Keuper-sand soils. It is thus proved that the large number of soils grouped under the name " general diluvium " contain a whole series of terrace, gravel and moraine soils, that the group " Keuper general " contains a large number of other soils, *e, g.*, upper " Bunter Keuper ", uppergy psum " Keuper ", etc. The lack of more definite information as to the exact place from which the soil has been taken, or of the proper geological section (profile), caused us, in concluding about each soil, to place it more in agreement with the upper members of a formation than with the lower ones. Thus, while the diversity of the soil material, well known in its geological particulars, diminished considerably, the number of sub-divisions of the larger geological formations increased considerably.

After this preliminary segregaton of the different formations, each soil of each group was entered in a definite column in a table according to the results obtained in the hydrogen-ion concentration determination, total acidity and lime requirement determinations. In the case of a considerable number of soils they could not be placed in any definite geological formation and all those were combined, and entered in a column as " Soils with no definite character " (geological). In this way Table II was obtained.

TABLE II — *The geological character of the soils investigated, in their re*[illegible]

Geological character of the soils	Number of Samples	Reaction [illegible]												
		under 3.5		3.51–4.0		4.01–4.5		4.51–5.0		5.01–5.5		5.51–6.0		[illegible]
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
General *alluvium*	58	—	—	—	—	1	1.7	2	3.5	2	3.5	[illegible]	[illegible]	4
(*a*) Garden soils	67	—	—	—	—	1	1.5	3	4.5	5	7.5	7	10.4	14
(*b*) River soils	21	—	—	—	—	1	5	1	5	1	5	1	5	3
General *diluvium*	610	—	—	—	—	21	3.5	52	8.5	41	6.7	98	[illegible]	143
(*a*) Diluvial loams	44	—	—	—	—	—	—	3	6.8	5	11.4	21	47.7	5
(*b*) Diluvial loams over Miocene	17	—	—	—	—	1	—	3	—	1	—	5	—	1
(*c*) Loess	20	—	—	—	—	—	—	—	—	—	—	—	—	1
(*d*) Loess loams	33	—	—	—	—	—	—	—	—	—	—	6	17	5
(*e*) Diluvial sands	10	—	—	—	—	1	—	2	—	1	—	1	—	2
(*f*) Recent morain gravel soils	5	—	—	—	—	—	—	—	—	—	—	—	—	—
(*g*) Loam over high-terraces	31	—	—	—	—	1	3.2	10	32.2	4	12.0	[illegible]	[illegible]	5
(*h*) Loam over low-terraces	5	—	—	—	—	—	—	—	—	—	—	—	—	—
(*i*) Soils of recent valley terraces	6	—	—	—	—	—	—	—	—	—	—	—	—	—
(*k*) High moor soils	9	1	—	1	—	1	—	1	—	1	—	—	—	4
(*l*) Low moor soils	21	—	—	—	—	—	—	—	—	—	—	5	24	2
General *Tertiary*	77	—	—	—	—	2	2.6	7	[illegible]	3	[illegible]	11	[illegible]	[illegible]
(*a*) Tertiary sands	20	—	—	—	—	—	—	1	5	1	5	3	15	4
(*b*) Flysch of the lower Alps	5	—	—	—	—	—	—	—	—	—	—	—	—	—
(*c*) Brackish molasse	3	—	—	—	—	1	—	1	—	—	—	—	—	—
(*d*) Miocene fresh-water lime	3	—	—	—	—	—	—	—	—	—	—	—	—	—
General *Cretaceous*	4	—	—	—	—	—	—	1	—	—	—	3	—	—
(*a*) Lower chalk	7	—	—	—	—	—	—	—	—	—	—	—	—	—
General *Jurassic*	[illegible]	—	—	—	—	—	—	—	—	—	—	—	—	6
(*a*) Middle Oolite	22	—	—	—	—	—	—	—	—	—	—	—	—	4
(*b*) Lower Oolite (Dogger)	11	—	—	—	—	—	—	—	—	—	—	—	—	2
(*c*) Lower Oolitic iron sandstone	[illegible]	—	—	—	—	—	—	—	—	—	—	1	—	—
(*d*) Lias	[illegible]	—	—	—	—	—	—	—	—	—	—	—	—	2
(*e*) Alp-covering loams	[illegible]	—	—	—	—	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

hydrogen-ion concentration, total acidity and lime requirements [illegible]

-7.0	7.01–7.5		7.5 and over		Total acidity (Daikuhara) in 100 gms. of fine soil: above 15 cm.		5.1 to 15.0 cm.		5.0 cm.		none		Lime requirements: absolute		conditional		none	
%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
36.2	24	41.3	3	5.2	—	—	1	2	3	5	54	93	4	7	2	3	[illegible]	[illegible]
31.3	15	22.3	1	1.5	—	—	1	1	9	14	57	85	9	13	6	[illegible]	[illegible]	[illegible]
19	9	42	1	5	1	5	—	—	2	10	18	18	3	14	1	5	17	[illegible]
23.8	105	17.2	5	0.8	5	1	11	2	192	31	402	66	139	23	136	22	333	[illegible]
11.4	1	2.3	—	—	—	—	—	—	30	68	14	32	15	34	23	52	[illegible]	14
—	—	—	—	—	1	—	—	—	6	—	10	—	5	—	6	—	6	—
30	10	50	3	15	—	—	—	—	—	—	20	100	—	—	1	5	19	95
61	2	6	—	—	—	—	—	—	6	18	27	82	3	9	5	15	[illegible]	76
—	—	—	—	—	—	—	—	—	3	—	7	—	—	—	7	—	3	—
—	—	—	2	—	—	—	—	—	—	—	5	—	—	—	2	—	3	—
3.2	—	—	—	—	—	—	—	—	22	71	9	29	17	55	10	32	[illegible]	13
—	4	—	1	—	—	—	—	—	—	—	5	—	—	—	—	—	5	—
—	6	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—	[illegible]	—
—	—	—	—	—	—	—	—	—	7	—	2	—	5	—	4	—	—	—
52	3	14	—	—	—	—	—	—	5	24	16	76	—	—	5	24	16	76
15.8	14	18.1	9	11.7	1	1	1	1	27	36	48	62	14	18	20	26	43	[illegible]
25	3	15	3	15	—	—	—	—	2	10	18	90	3	15	5	25	12	60
—	4	—	—	—	—	—	—	—	—	—	5	—	—	—	—	—	[illegible]	—
—	—	—	—	—	—	—	—	—	2	—	1	—	2	—	—	—	1	—
—	2	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	3	—
—	—	—	—	—	—	—	—	—	4	—	—	—	1	—	3	—	—	—
—	—	—	—	—	—	—	—	—	—	—	7	—	—	—	—	—	7	—
1	29	59	1	2	—	—	—	—	1	2	48	98	—	—	2	4	[illegible]	[illegible]
[illegible]	8	36	—	—	—	—	—	—	—	—	22	100	—	—	—	—	[illegible]	[illegible]
—	1	—	1	—	—	—	—	—	—	—	11	—	—	—	—	—	11	—
—	1	—	—	—	—	—	—	—	—	—	8	—	—	—	2	—	[illegible]	—
[illegible]	22	49	1	2	—	—	—	—	1	2	44	68	—	[illegible]	1	[illegible]	14	[illegible]
[illegible]	—	—	—	—	12	14	7	8	[illegible]	18	[illegible]	60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE

Geological character of the soils	Number of Samples	Reaction Grou[illegible]												
		under 3.5		3.51–4.0		4.01–4.5		4.51–5.0		5.01–5.5		5.51–6.0		6.[illegible]
		No.	%	No.	%	No.	%	No.	%	No.	%	No	%	N[illegible]
General *Keuper*	35	—	—	—	—	3	9	5	14	2	6	4	[illegible]	6
(*a*) Alpine Keuperhät . . .	1	—	—	—	—	—	—	—	—	—	—	—	—	—
(*b*) Rhaetic yellow Keuper.	4	—	—	—	—	—	—	—	—	—	—	1	—	3
(*c*) Upper red Keupperlett.	12	—	—	—	—	—	—	—	—	—	—	—	—	3
(*d*) Stuben and Burg sandstone	40	—	—	2	5.0	3	7.5	4	10.0	2	5.0	11	27.5	13
(*e*) Blasen and Platten sandstone	80	—	—	—	—	2	2.5	16	20.0	15	18.8	22	27.5	14
(*f*) Upper gypsum Keuper.	26	—	—	—	—	—	—	—	—	3	12	4	15	6
(*g*) Schilf sandstone	8	—	—	—	—	2	—	—	—	—	—	2	—	3
(*h*) Lower gypsum Keuper.	12	—	—	—	—	—	—	—	—	—	—	—	—	1
(*i*) Lower Keuper (letten) sandstone	16	—	—	—	—	—	—	—	—	—	—	2	—	[illegible]
General *Muschelkalk*	21	—	—	—	—	—	—	—	—	—	—	1	5	6
General *Bunter sandstone* . .	3	—	—	—	—	—	—	1	—	—	—	1	—	—
Northerly upper Franconian Palaeozoic with older igneous rocks	37	—	—	1	2.7	12	32.4	12	32.4	5	13.5	5	[illegible]	1
Recent igneous rocks	2	—	—	—	—	—	—	2	—	—	—	—	[illegible]	—
General *Primary rocks*	[illegible]	—	—	30	10.8	91	32.6	94	33.5	27	9.6	21	7.5	14
(*a*) Granite	25	—	—	—	—	5	20	11	44	7	28	1	4	—
(*b*) Gneiss and Glimmerschiefer	15	—	—	—	—	—	—	4	—	2	—	4	—	[illegible]
Soils from manure experiments	12	—	—	—	—	—	—	—	—	—	—	1	—	3
Soils with no definite . . .	245	—	—	1	[illegible]	1[illegible]	[illegible]	23	[illegible]	7	[illegible]	[illegible]	[illegible]	[illegible]
geological character	1[illegible]	—		—		5		11		3		1[illegible]		[illegible]
	2,225	1	0.04	35	1.[illegible]	1[illegible]	7.9[illegible]	276	1[illegible].33	144	6.[illegible]	[illegible]	[illegible]	[illegible]

					Total acidity (Daikuhara) in 100 gms. of fine soil								Lime requirements					
	7.01-7.5		7.5 and over		above 15 cm.		5.1 to 15.0 cm.		5.0 cm.		none		absolute		conditional		none	
%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	3	9	1	3	1	3	1	3	12	34	21	60	9	26	7	20	19	54
-	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—
-	—	—	—	—	—	—	—	—	1	—	3	—	—	—	3	—	1	—
-	1	—	3	—	—	—	—	—	2	—	10	—	—	—	2	—	10	—
.5	—	—	—	—	3	7.5	2	5	3	7.5	32	80	12	30	15	37.5	13	32.6
.2	2	2.5	—	—	2	2.5	2	2.5	43	54	33	41	35	44	33	41	12	15
	3	12	—	—	—	—	—	—	8	31	18	69	5	19	6	23	15	58
	—	—	—	—	—	—	2	—	—	—	6	—	2	—	5	—	1	—
	7	—	—	—	—	—	—	—	—	—	12	—	—	—	1	—	11	—
	6	—	—	—	—	—	—	—	2	—	14	—	1	—	1	—	14	—
	8	38	1	5	—	—	—	—	2	10	19	90	1	—	2	10	19	90
	1	—	—	—	—	—	—	—	2	—	1	—	1	—	1	—	1	—
7	—	—	—	—	5	14	7	19	19	51	6	16	30	81	4	11	3	8
	—	—	—	—	2	—	—	—	—	—	—	—	2	—	—	—	—	—
	—	—	—	—	80	29	68	24	114	41	18	6	246	88	20	7	14	5
	—	—	—	—	2	8	2	8	21	84	—	—	20	80	5	20	—	—
	—	—	—	—	—	—	—	—	6	—	9	—	3	—	1	—	[illegible]	—
	1	—	1	—	—	—	—	—	2	—	10	—	—	—	1	—	[illegible]	—
23	60	26.6	5	2.3	22	10	13	6	51	22	130	62	81	[illegible]	11	23	[illegible]	44
21	28		3		—	—	—	—	—	—	—	—	—	—	—	—	—	—
[illegible]	384	16.56	45	1.95	—	—	—	—	—	—	—	—	—	—	—	—	—	—

The results show that, the number of soils which can be definitely grouped as a geological unit is very large, when compared with the few less known soils of secondary members of those units. This strikes one especially in the case of diluvium where we notice 610 completely known soils and only 201 soils with single separation.

The following considerations apply to the numbers on the left side of the table.

It is especially important to notice and to remember the series of numbers given under the heading "The total number of investigated soils." This shows a slow rise up to P^H 5.0, then a distinct decrease (8), then again a rise up to P^H 7.0, and again a decrease.

If we compare with this the numbers in the column "Soils with no definite character", we see something very similar. From these and other investigated series of soils the following may be concluded, *that a considerable number of investigated Bavarian soils are neutral to weak acids, and acid to strong acids and that only about a third of them are alkaline to strongly alkaline.* Comparing with these two series of numbers those in the columns "general diluvium", "general alluvium", "general tertiary" and "general Keuper", and taking into account only relative numbers we notice *a fair similarity* between all of them.

These relations can be well illustrated by curves (9). In the curve-table shown in fig. 261 the abcissae represent the steps of P^H, while the ordinate represents the percentage of soils of "The total of all soils" (curve *a*), "soil without definite geological character" (*b*), "genneral diluvium (*c*), "general Keuper" (*d*), "general primary rocks" (*e*), recurring in each P^H group. The very nearly parallel character of these curves is unmistakable. *From this we may derive the following rule that, the fact of a soil belonging to a certain geological formation, e.g.* "diluvium", "Keuper", "alluvium" "*indicates nothing else but our ignorance of that soil. An exception is the weathering soils of primary rocks represented in our curve table* (fig. 262).

These soils coming principally from the Bavarian forests and from the Fichtelgebirge are principally weathering products of granite and gneiss, and partly of rocks yielding as their weathering products syenite, diorite, diabase and other lime containing substances. The curve shows in any case that the majority of soils derived from primary rocks are acid and only a small number of them is neutral or weakly alkaline (10).

With these series of numbers of only generally geologically known soils, were compared those of soils belonging to secondary members of formations. What strikes one looking at the table, is the comparatively small number (total) of those soils known.

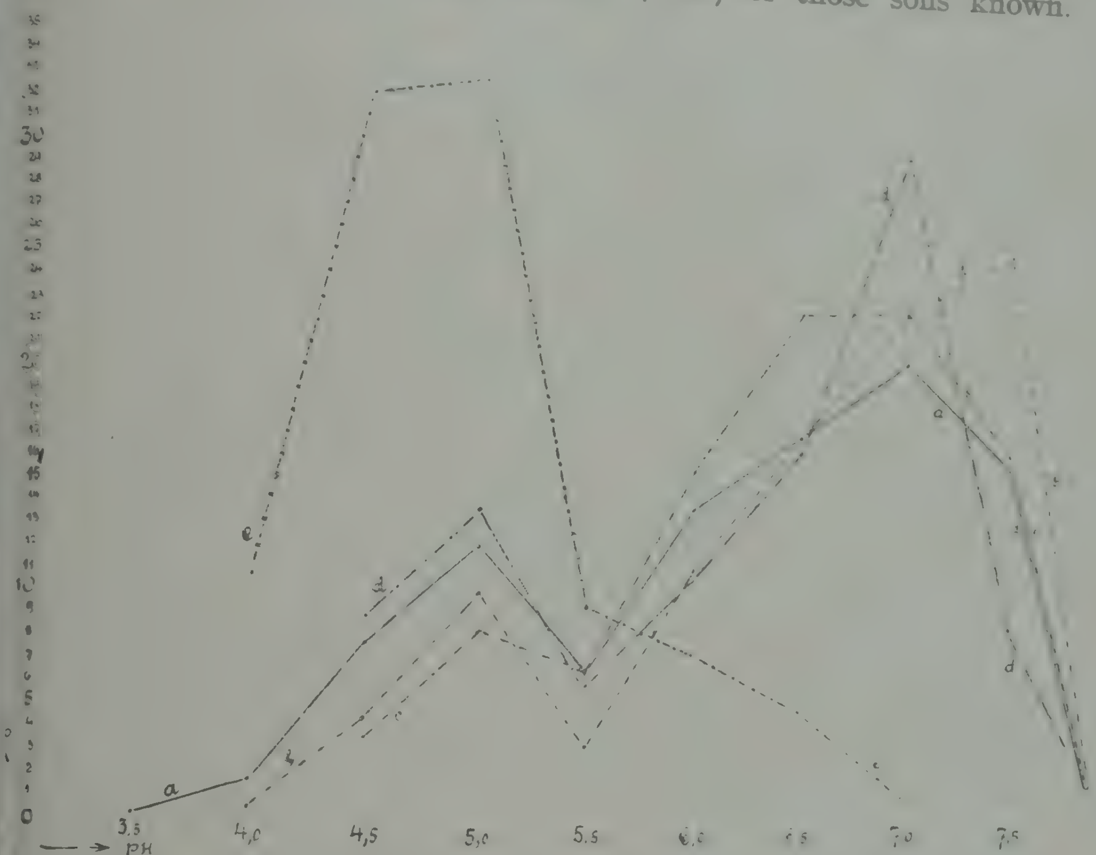

FIG. 261. — Curve-Table I.

a = ———————— Total for all soils.
b = – – – – – – – Soils with no definite geological character.
c = — · — · — · Soils of general diluvium.
d = — ·· — ·· — ·· Soils of general Keuper.
e = –×–×–× Soils of general primary rocks.

In a few cases as, *e.g.*, in the case of "low-terrace soils". "newer valley-terrace soils", "brackish molasse", "miocene fresh-water lime", "lower and upper gypsum keuper" and many other series, the number is at first so very small that they do not indicate anything at all. In other cases, on the other hand, there is a definite tendancy noticeable, the number-series become shorter and closer and are limited only to a certain quite definite and

typical P^H region, similar to the case of "general primary rocks".

Several of these typical series of numbers are represented in

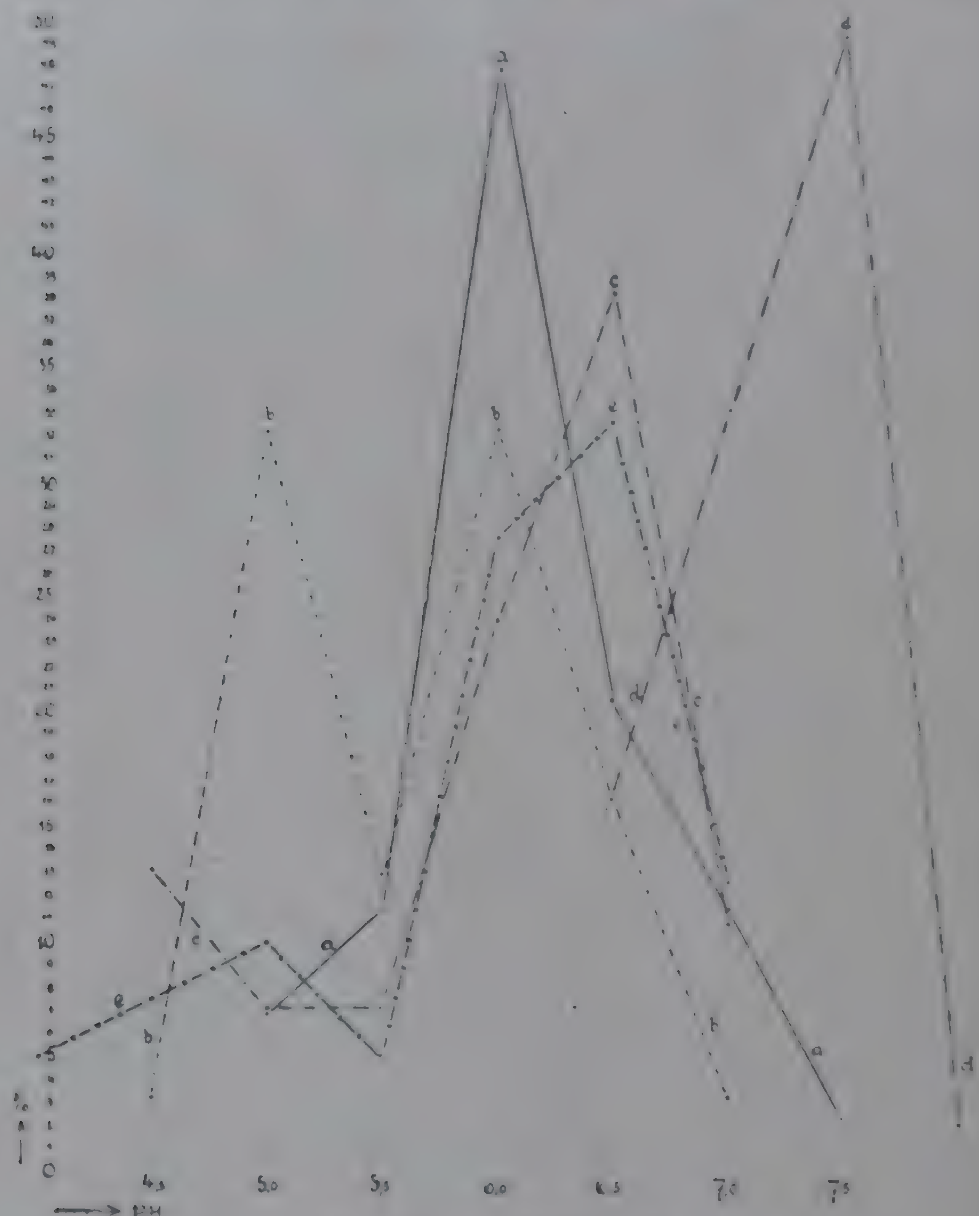

FIG. 262 — Curve-Table II.

a = ———————— Franconian diluvial soils.
b = - - - - - - - - Soils of high-terrace loam.
c = — · — · — · Alpine pasture soils.
d = — ·· — ·· — Lias soils.
e = —×—×—× **Blasen and Platten sandstone soils.**

curve-table II. Only the most numerous soil-series were represented: "diluvium soils in Franconia" (*a*), "high terrace loams"

(*b*), " Alpine pasture soils " (*c*), " Liass " (*d*) and " Blasen and Platten sandstone " (*e*). True, the curves in the case of the " alb-covering soils ", which are only slightly homogenous, and in the case of the diluvial soils coming from different parts of south-middle Franconia, and in the case of the partly meadow and partly arable loam soils of the Bavarian upper-terrace still extend over a considerable area, yet in distinction to the curves in curve-table I. show a rapid rise and a typical culmination.

Leaving out of consideration the error due to carbonic acid, the following can be said :

The *Franconian diluvial soils* extend over the range for P^H 4.51-7.0, with a culmination at P^H 5.51-6.0. The sloping branch on the alkaline side of the curve would in the case of a largern umber of soils be steeper and come to an end between P^H 6.5-7.0.

The *high-terrace loany soils* lie between P^H 4.01-4.5 and 6.51-7.0 with an apparent double culmination at P^H between 4.51 and 6.0. Also in this case we should get a steeper curve on the alkaline side, if dealing with a larger number of soils.

The *Alpine pasture soils* lie between P^H 4.01-7.0. The culminating point of the curve is between P^H 6.01-6.5. The left acid branch of the curve seems to be greatly influenced by carbonic acid (see note 8). The point of origin of the curve should really have been on the abcissae between P^H 4.5 and P^H 5.0.

The character of the curve for " the Liass soils ", in the right of the co-ordination system, should correspond very nearly with the actual facts, although a larger number of soils would probably cause a narrowing to the right.

The fairly large P^H region between 4.01-7.5 is occupied by the *Blasen and Platten sandstone soils* with their maximum value at P^H 5.51-6.0. It may be that in the case of these sandy-soils as in the case of most of such geological soils their rather wide P^H region may represent also the effects of manuring, for it is a fact that farmers on sandy soils use much more artificial manure than farmers on loamy soils, and moreover slight amounts of manure have a considerable effect in a chemical sense, on sandy-soils.

In segregating the different series of geologically similarly stratified soils it is not only important to take account of the manuring, and it must be pointed out not only that of light soils, but also to a less extent also that of heavier soils, and also the mode of cultivation in connection with its usage. It is quite probable

that the considerable distribution within wide P^H regions, which is evident on the curve-table II, is due to the different use of the soils there shown. Already R. GANS (11) believed it to be probable that the non ploughed soils, *e.g.* pasture-land, passes sooner into a state of absorptive-unsaturation, than those soils where ploughing produces an intermixing of the upper layers, poorer in bases, with the lower ones which are richer in bases. That in this way a constant bringing upwards of the bases takes place, i. e., a kind of renewal may be true, although it still requires proving in the case of certain kinds of soils, as could be done in the case of the upper-Bavarian arable and pasture lands.

It should be pointed out that in considering fig. 262, it must be remembered that though every possible precaution was taken to investigate qualitatively each soil as to its mechanical agreement with geologically similar soils, it is possible that several geologically not quite similar soils were placed together, which, although showing the same or very nearly the same geological origin, differ, however, in the size of their particles.

These differences are in many cases caused by differences of slope, as was described by W. KOEHNE and H. NIKLAS (12) and which is of primary importance in the separation of the different classes of soils.

The weathering, progressing as it does, in the direction of slope, and which constantly exposes fresh amounts of base, together with the washing action of water and the deflating and accumulating action taking place more particularly on slopes, must be considered as very important factors in determining the size of the particles, and by this means influencing the reactions of the soil.

Important results are obtained not only from microscopic rock analysis but also from soil analysis.

Equipped with those methods of investigation we had, in several cases as *e.g.* in the case of the heterogenous covering soils and in the case of the partly loamy and partly sandy Franconian diluvial soils, to undertake yet another separation.

In our opinion, *such a procedure would enable scientific conclusions to be drawn as to the relation between the lime-content and reaction-character of a soil and its geological mode of origin, or its underlying matrix, and also with the help of advanced cartography of scale* 1 : 25,000 *or* 1 : 5 000 *and reaction analyses, to apply the conclusions arrived at to geologically and agriculturally similar soils.*

There is no doubt that taking all necessary precautions in forming general conclusions, it would then be possible to indicate practical lines along which further manuring should take place (1).

From further work, carried out since September 1924, on the reaction character of Bavarian soils, the following may be concluded that the *true Alp-covering soils*, which are recognised only with difficulty by many, on account of their showing all transition stages of the weathering products of Franconian dolomite and of other Jurassic members — *are typically deficient in lime and are of neutral mostly of acidic character, and that the poverty of the clover, Mazagan vetch and especially of lucerne is due to this deficiency. They contrast very strongly in this respect with the different Jurassic weathering soils, which in many cases adjoin them. Similarly, the more sandy or loamy middle Franconian diluvial soils are concentrated in a comparatively narrow region of acid reaction, and finally the loamy-soils of the upper-Bavarian "high-terrace" differ from the soils of the newer "valley-terraces" and partly from those of the "lower-terraces" in that they have in the majority of cases a weakly acid to a strongly acid reaction.*

In recent times investigations were begun on the reaction character of the diluvial loamy-soils and Miocene-sand and gravel lying in the Tertiary belt south of the Danube. The similar investigations of the previous year indicated a considerable heterogenity and a distribution over a large P^H region (see Table II). The results obtained could not have been used as evidence for two reasons, firstly because the number of soils investigated was far too small, and secondly, because the soils investigated were, geologically considered, of a too heterogenous character. This year's investigations on these quaternary soils, after separating out the deeper layers of a Liass character, showed mostly an acid reaction.

In the end, such systematic treatment of the results obtained in the geological investigations of geologically typical series of soils, will enable us, through careful formation of generalisations, to advance the knowledge of the chemical behaviour, which is of such great importance to agriculture.

The amount of care to be exercised depends upon whether:

(1) in taking the sample, attention was paid to the agricultural and manure-technical, as well as to the plant-organisation side;

(2) attention was paid to the geological section (profile) and thus to the mode of formation;

(3) the soil is horizontal or whether inclined and in what direction ;

(4) in summing up the results of the investigations on the chemical character attention was also paid to the differences in the analyses of the different soils, which often occur even in limited spaces.

Only if and when all these points have received the attention they deserve, are we entitled to apply deductively, the conclusions arrived at in the chemical investigation of geologically homogenous series of samples, to corresponding kinds of soils. From our experience we advise very special care in the treatment of samples supplied. *Such systematically carried out investigations will give for homogenous series of soils, a typical series of numbers lying within a constant and limited P^H region.* In this way it will be possible to prove the existence of many other acid soil-types, *in which the base-deficiency is geologically and agriculturally caused, which showed itself, may be, for a long time in bad harvests or lime-deficiency, or may have existed for a long time in a latent state and became active only through the use of an unsuitable artificial manure.* The recognition of these facts will put in their proper place the very general statements as to the injurious action of acid manures.

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(3) A review of the work, of R. GANS is given in *Internationale Mitteilungen für Bodenkunde,* Vol. III (1913), p. 529.

(4) More details of the organisational work are to be found in *Landwirtschaftliches Jahrbuch v. Bayern.* Jahrgang, 1925.

(5) Since September 1924 a further number began sending in samples.

(6) *Landwirtschaftliches Jahrbuch von Bayern,* Jahr 1925.

(7) This number increased from 1-9-1924 till 28-2-1925 by 2 481 soil samples.

(8) We have to deal here with the influence of carbonic acid. The influence of carbonic acid is strongest in the region of P^H 6-7, although it is felt in the region P^H 5-7.

(9) In drawing the curves we always used the upper value of the P^H interval, from table II, as the abscissae, thus, e, g., for P^H 6.01-6.5 we used 6.5. In this way the curves represent the hydrogen-ion concentration in water extract. It is worth noticing that the shifting caused by the curves in the coordinate system affects unfavourably especially the curves of the acid soils.

(10) These observations are in agreement with the exhaustive investigations on the lime-content carried out at the central agricultural experimental station Munich in the years 1892-96, and which was then under the direction of SOXLETH. The results then obtained show in the case of nearly all soils of the Bavarian forest, deficiency in carbonate of lime.

(11) *loc. cit.*

(12) *loc. cit.*

(13) H. NIKLAS in the explanations to the Mühldorf section of the geological map of Bavaria (1 : 25,000) p. 82, has drawn conclusions from the results of the chemical investigations on the soils as to the their lime requirements, and he and W. KOEHNE — the latter from the results of borings — concluded that the soils of the Pietenburg level require lime urgently, while those of the younger Inn terrace do not need liming. Except the recognition whether a particular soil requires liming or not, a decisive factor in the choice of a manure is the reaction character of the soil. It would therefore be of great importance to the scientific advisers of the practical farmer if they could indicate, on the basis of a knowledge of the reactions of certain widely distributed soils, the best manures, i. e., yielding optimum results for a given soil.

THE CLASSIFICATION OF SOILS ON THE BASIS OF ANALOGOUS SERIES IN SOIL FORMATION.

The problem of the classification of soils, the history of which is almost as old as the history of soil investigation itself, has not yet reached a satisfactory solution. In particular, it is not yet completely resolved by the Russian pedologists, though the latter proposed several schemes for classification of soils. Among this classification two were of greater importance in the development of soil investigations in Russia, those of Prof. N. SIBIRCEFF (1895) (1) and Prof. K. GLINKA (1902). (2) The classification of Prof. SIBIRCEFF is based on the principle of *zonality*, that is on the factor characterizing their geographical extension on the surface of the globe. The classification of Prof. GLINKA is constructed according to the factor of *humidity*, because he considers that moisture is the pre-eminent factor in soil formation.

From personal investigations and analysis of material collected by Russian pedologists, it was possible for the author to establish that soils form several genetically independent divisions, whose soil-formation is quite specific. Within the limits of every division the soil passes a determined cycle of development — *progressive* — till the moment of maximal expressiveness of its properties and — *regressive* — from the moment of its beginning to decompose into more simple integral parts. The fundamental stages of this cycle are called *types*. In the first instance can be named four divisions : *thermogenic, phytogenic, hydrogenic, and halogenic.* In the best investigated phytogenic division found in the temperate zone of the globe, the process of the evolution of soils is conceived as follows :

In the first stage of development, in *desert*, we have a *crust weathering* in different stages of decomposition, not at all subject to the influence of the phytosphere and only in a slight degree to that of the hydrosphere. In the next stage, in the zone of *half-desert*, the soil-cover is represented by a type with scarcely marked morphological signs — *grey-soils*, in which the soil-formation is expressed by washing out of easily soluble alkali-salts, some alkalisation of alkaline-earths and insignificant accumulation of organic matter. Therefore a difference between the soil and the material rock is observed in the chemical composition only ; as to the morphology, there are scarcely visible signs of difference. Further, in the zone of *dry steppe*,

FIG. 263. — Sketch Map of the soil-cover of the world, after Prof. K. D. GLINKA.

A, Tundra soils; B, ash-like soils; C, bog and ash-like soils; D, grey nodular soils; E, black soils; F, nut brown soils; G, brown soils; H, grey soils; I, yellow soils; L, red soils; M, red soils of tropical deserts and arid savannahs; N, mountain soils.

we meet rich *brown* and *nut-brown* soils, in which the process of soil formation is expressed by alkalization of alkaline-earths, especially in the form of carbonates, which form a distinctly marked alluvial horizon. At the same time a visible accumulation of organic matter is observed, the soil begins consequently to acquire a definite structure consisting of three horizons.

The next, *black-soil zone*, with fertile *chernoziom*, is characterised by the full alkalization of carbonates of alkaline-earths and the maximum accumulation of organic matter. In this stage the soil is at the height of its properties, power and productivity. With this stage finishes the first — *progressive* — period of history of the development of the soil. After this period in the development of soil begins the second stage — that of regression and dying away. This period begins with the *grey forest, nut-like soils*, which form generally, as a consequence of the development of forests on the black soil. At the same time, in consequence of more mobile combinations, the process of humification nearly stops; the former stores of humus are alkalized by the soil solution, continually streaming downwards, because, in consequence of the setting free of absorbed Ca, the humates become mobile and are drawn away by soil-solutions into the depth of the lithosphere. With the decomposition of organic matter its protecting and conservative influence ceases, and an energetic process of further weathering of mineral substance of the soil takes place; it consists now in transferring the oxides deeper into the ground. The carbonic acid, set free in abundance by the energetic mineralization of organic residues, probably plays a great part in this last process of *ash-like soil formation*. This process in course of its development leads the soil to the conclusion of the cycle of its evolution — poor *ash-like soils* (podsol), when all more or less mobile substances are removed and only the inert silica remains in the composition of the soil mass. Such a soil cannot be a source of food material for herbaceous plants, except the simplest forms. It is suitable for trees, which obtain food material from the deeper layers. An analogous cycle of development of the soil-cover is to be found in every division of soil-formation. For instance among the *salted soils* of the temperate zone the division of *halogenic* soils consists of six types, which in their morphology, chemistry and distribution are quite analogous to the above mentioned types (3). It is possible to observe the same series in *thermogenic* soils of the torrid zone *laterites*. Notwithstanding the scarcity of investigations in this zone, it is quite established that, the

TABLE I. — *The Classification of Soils by Prof.* D. VILENSKY.

Series / Division		A Type	B Type	C Type	D Type	E Type	F Type
Thermogenic	T	Red soil of tropical half-desert TA	Red soil of arid savannah TB		Red soil Laterite TD	Degraded red soil TE	Ash-like red soil TF
Phytogenic	P	Grey soil PA	Brown soil PB	Nut-brown soil PC	Blacksoil (Chernoziom) PD	Grey nodular soil PE	Ash-like soil (Podsol) PF
Hydrogenic	H	Tundra soil HA	Half-bog soil HB		Bog soil HD		Ash-like bog soil HF
Halogenic	G	Dry salt soil GA	Prismatic soil GB	Pillared alkali GC	Black pillared alkali GD	Nodular alkali GE	Ash-like alkali GF
Thermophytogenic	PT	Yellow soils					
Thermohydrogenic	TH	Bog soils of torrid zone					
Thermohalogenic	TG	Salt soils of torrid zone					
Phytohydrogenic	PH		Pasture soil PHB		Black pasture soil PHD	Grey nodular soil PHE	Ash-like soil PHF
Phytohalogenic	PG	Alkaline grey soil PGA	Alkaline brown soil PGB	Alkaline nut-brown soil PGC	Alkaline black soil PGD		Alkaline ash-like soil PGF
Hydrohalogenic	HG	Light chloride sulphate salt soil HGA			Black carbonate salt soil HGD		
Orogenic	O	Greyish pasture soil OA	Brownish-grey pasture soil OB	Sward pasture soil OC	Black pasture soil OD	Grey nodular soil OE	Ash-like soil OF

process of soil formation in this region begins and finishes by types quite analogous to the corresponding ones of the temperate zone (4). Finally the same is to be observed in the *hydrogenic* division of *bog-soils*, distributed in the cold zone.

The author's classification (tab. 1) has for basis those analogous series in soil formation. Its highest classification unit is the *soil division*. The characteristics of those divisions are:

1. *Thermogenic division.* Distributed in subtropical, tropical and equatorial regions of the *torrid zone*, independently of the quantity of precipitation, that is to say, in half-desert, savannahs and forests. The prevalent factor of soil formation in this zone is the high and constant temperature, favourable to a rapid and complete (to the formation of CO_2) mineralization of organic residues and increasing the energy of chemical weathering of mineral substance of the soil. Enriched by CO_2, the soil solutions bring about rapid and energetic hydrolysis of silicates and alumino-silicates and remove not only the bases, but also the silica (quartz-silica excepted). As products of weathering, the hydrates of the oxides of iron and aluminium chiefly, also Mn_3O_4 and TiO_2 are accumulated and form the greatest part of the soil mass. As admixture, there are found grains of quartz, kaolinite, and incompletely weathered residues of minerals of the mother rock. Under the influence of high temperatures the oxides of iron dehydrate and pass into the form of less mobile anhydrates, *turite* especially, which causes the prevalence of a red colour among the soils of the given division. The intensity and the character of this colour varies in accordance with the content of iron in the maternal rock. The soils of the given division, as well as of all those following, are formed on all kinds of rocks, eruptive and sedimentary, in the primary and secondary (alluvial, eolik) layers. If the process of soil formation is of long duration the lithosphere can be penetrated to a very considerable depth.

2. *Phytogenic division.* Distributed in all regions of the temperate zone, independent of the amount of precipitation. The predominant factor of soil formation is the vegetation, causing considerable accumulation of decomposed organic matter in the soil. This accumulation is the result of insufficient energy in the decomposition of organic matter, owing to the comparatively low annual temperature and a long period of winter rest, during which the biological processes in the soil are interruped. The organic colloidal complexes (humates), absorbing the alkalized bases, hinder the process of weathering of

alumino-silicate substances of the soil, already delayed by the moderate temperature and the feeble activity of the soil solation. The accumulation of the most characteristic part of this soil, the decomposed organic matter, in consequence of its feeble stability, takes place only in external horizons of the mother rock and the process of soil formation does not reach a great depth.

3. *Hydrogenic division.* Chiefly distributed in the *cold region* — tundra and the adjacent part of the forest zone — but occurs in other zones also, if the special conditions of relief cause the stagnation of surface water, or the rise of soil water. The prevalent factor of soil formation in this division is the water, which acts directly, causing a heightened hydrolitic decomposition of the alumino-silicate part of the soil and indirectly forcing the air out of the soil and causing anaerobic conditions. Under the influence of water with carbonic acid in solution an energetic hydrolysis is produced which sets free large quantities of the elements of the silicates, as well as of organic-mineral substances. Therefore the marshy horizons have always, even in tundra, an alkaline reaction. Under the influence of alkaline water solutions, containing bicarbonates, the weathering of alumino-silicates takes place and brings about the formation of clays and accumulation of alumina, while the bases and oxides of iron are alkalized. The mobility of the chemical combinations of iron is quite evident in this case, because in the bog soils there are conditions suitable for the formation of protoxide of Fe combinations. Consequently in the bog soil there occur a whole a series of chemical compounds of iron, unknown in other soil types, among them : vivianite, sulphur compounds, FeS, FeS_2 (pyrite, marcasite), $FeCO_3$. At the same time, in consequence of imperfect aeration, the decomposition of organic matter proceeds very slowly and remains unfinished. It results in accumulation of a great quantity not only of humus, but also of carbonized organic matter, preserving traces of organisation.

4. *Halogenic division.* The principal factor of soil formation in this division is the saltness of the mother rock, or to be more exact, the *content of the absorbed sodium* in its colloidal part. This salinity can be of different origin : geological (sea-sedimentary), as well as that of soil (salt soils). When the rock is impregnated with sodium salts, an absorption of it takes place by colloidal complexes of sodium. Then, after the washing out of the rock or the salt soils of easily soluble salts, begins the alkalization of absorbed bases, during which soda is formed by the process of exchange of absorbed sodium for

calcium of $CaCO_3$ (5). The enrichment of soil solutions by soda makes them a very energetic reagent, producing first the alkalization of decomposed organic matter and then of oxides, both being in the alkaline solution in the form of zole. Penetrating through cracks and capillary vessels into the depth of the rock, they form not far from the surface, an alluvial horizon, overfilled with colloids, which in the dry state forms distinct prismatic or pillared pieces, and when moistened swells, becomes water-tight and creates on the surface of the soil the conditions of temporary saturation. In consequence of very unfavourable physical properties of the soil, of a considerable alkalinity of its external horizons and of the presence at a slight depth of easily soluble salts, the vegetative cover of halogenic soils is, as a rule, poor and sparse, the accumulation of decomposed organic matter insignificant, the greater part of it being immediately alkalized into the alluvial horizon. Being bound by its origin to a particular property of the mother rock, its salinity, which depends upon the origin of the rock and can be met everywhere, the halogenic division is intrazonal.

Nevertheless, as the salinity itself of the mother rock, especially the secondary one, arising during the soil formation, takes place more easily in the conditions of a hot and dry climate, where evaporation prevails over precipitation, those soils are mostly distributed in steppe and half-desert regions.

Such are the properties, origin and distribution of the *fundamental divisions* of soil formation. Between them there may exist, and really do exist, *intermediate divisions*, uniting fundamental properties of the two, though in a very changed form. Those divisions are:

5. *Thermophytogenic division.* It consists of the little investigated yellow-brown and reddish-yellow soils with low content of humus and considerable quantity of oxides. Distributed in South Europe (France), Japan, South-Eastern United States. They are united by Prof. GLINKA in one group, to which he gives the name of *yellow soils* (6). Their types are not yet investigated even approximately.

6. *Thermohydrogenic division.* To this division belong half-bog and bog soils of equatorial, tropical and subtropical regions, very little investigated.

6. *Thermohalogenic division.* To this division belong the salt soils of the torrid zone, whose morphology, chemistry and geography

THE PRINCIPAL SOIL - TYPES OF THE WORLD.

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

Thermogenic division

T

Torrid zone

A

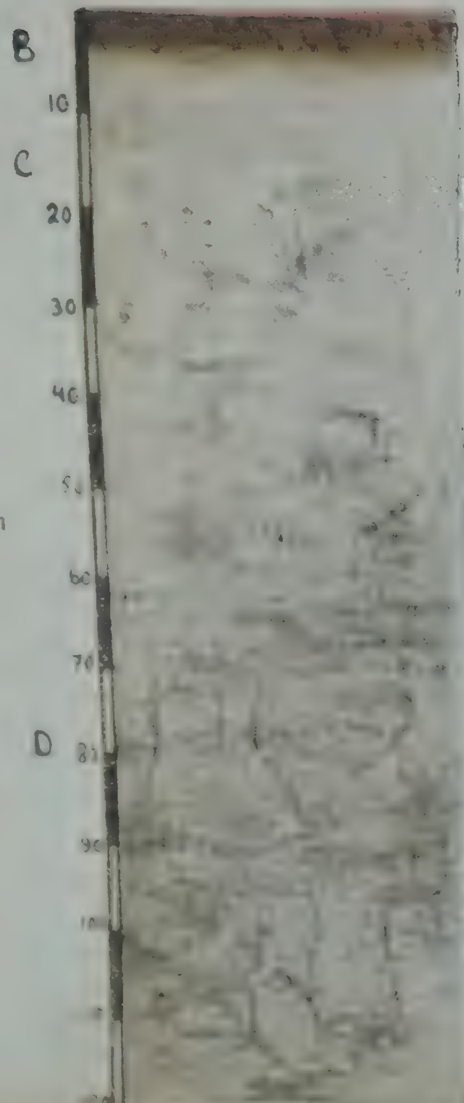
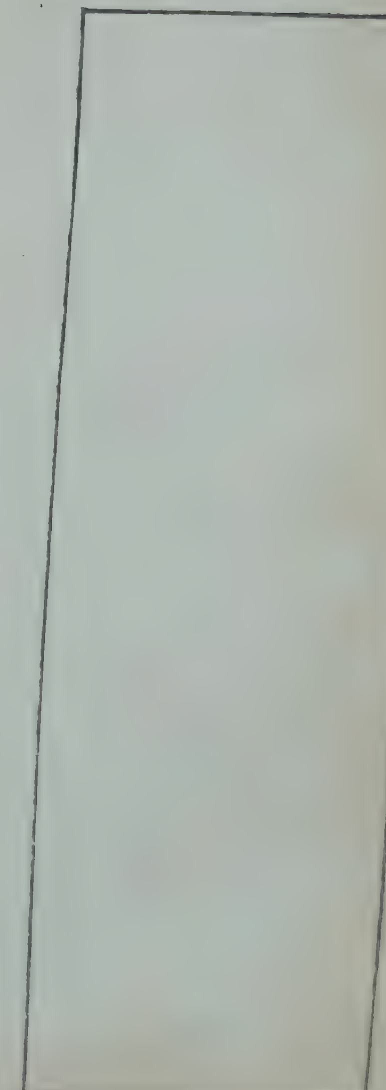


FIG. 264

B

C



By Prof D. G. VILENSKY. Drawn by M. Podjakonoff.

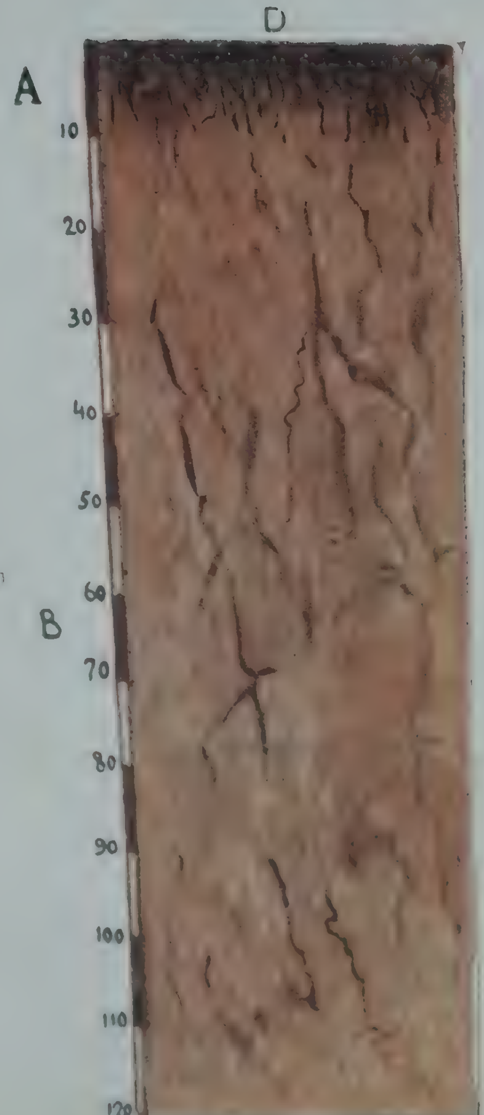


FIG. 267.

Red soil. Laterite soil.

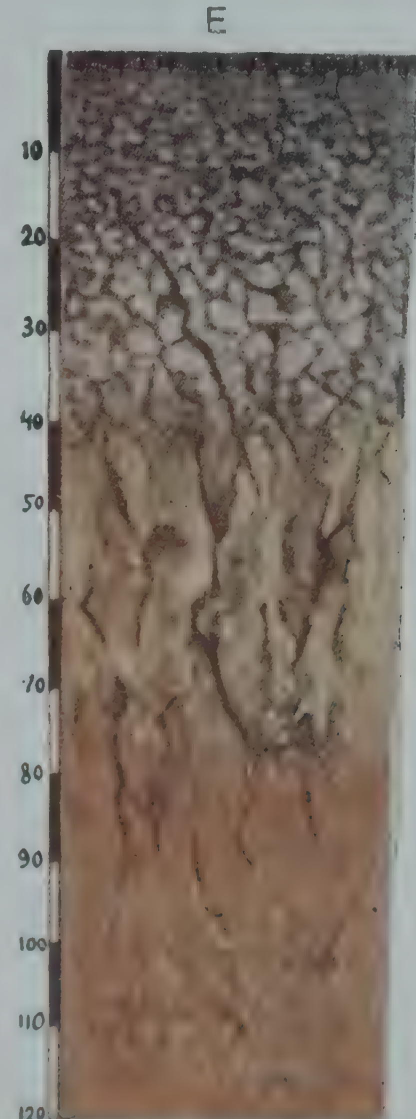


FIG. 268.

Degraded red soil

FIG. 269

Ash-like red soil

are, from the point of view of contemporary pedology, as little investigated as those of the previous divisions.

8. *Phytohydrogenic division.* To this division belong the soils of the forest region of the northern part of the temperate zone, from the sward-soil to the ash-like and, in particular, the meadow-soil. The process of soil formation in this division, owing to the especially favourable properties of the zone in question for the settlement of tree-vegetation, progresses very rapidly and we often meet there its last stages, the ash-like (podzol) soils.

9. *Phytohalogenic division.* To this division belong slightly alkaline soils, intermediate between phytogenic soils and alkaline. They form types quite analogous to those of phytogenic soils.

10. *Hydrohalogenic division.* Includes *salt soils* which are formed where the conditions of the relief allow the soil water to approach the surface, so that its evaporation from the surface becomes possible. If the soil water contains in solution a considerable quantity of mineral salts, those salts are concentrated on the surface of the lithosphere in gradually increasing quantity. As a rule, in those soils the upper horizon is saturated with easily soluble salts, and the lower horizon has the characteristic of swampness.

The ten enumerated fundamental and intermediate divisions of soil formation embrace, as it appears, the whole number of soil-bodies formed on the surface of the earth in conditions of plain, as well as of mountain relief. Only in regard to the last, the possibility is not excluded of classifying the group of soils, known as *high-mountains soils*, into a separate division of *orogenic* soils, quite independent of others. It might be done in course of time, after investigation of mountain soils in a greater number of regions.

The soils of divisions in the classification table (Table I) form the horizontal rows. Every division is divided into six types and those types form the basal units of the soil cover. The types are analogous in all the divisions and therefore they form the vertical rows in the classification system. Consequently, every type lies at the point of intersection of the two coordinate divisions and series. In the total, with 11 divisions, 66 types find their natural place in the table. Their existence is theoretically quite possible; in fact, only 42 have been at present investigated.

The characteristics of the principal types described are as follows.

I. Thermogenic division.

T. A. *Red soil of the tropical half-desert.* Is characterized by insignificant thickness of alluvial horizon (B = 6 cm.) (7), yellowish-red colour, slightly foliated structure and friable texture. Under the above mentioned horizon lies the alluvial horizon in separate patches, more often a whole layer of lime and gypsum; effervesces on the surface with HCl. Described up to the present only in the halfdesert of North Africa (in Algeria) by the pedologist DRANICIN (8).

T. B. *Red soil of arid savannah.* Hor. B. about 25 cm. thick, brown-red, structure very slightly shown as a thin crust on the surface. Hor. C. mostly compact, structurless lime flag. Effervesces on the surface with HCl. Distributed in arid alfa (*Stipa tenacissima*) savannah of North Africa.

T. D. *Red-soil Laterite.* Consists almost exclusively of one hor. B, characteristics of A and C. very slightly shown and their nature has been very little studied.

The thickness of B is very considerable. Nevertheless we have no exact knowledge of it in the conditions of the primary layers of the soil. The colour of the horizon varies: red, crimson, orange, downwards generally yellowish, upwards tending to a brown tint. Structure indistinct, cloddy, texture friable, spongy or cellular. The type described distributed in all subtropical, tropical and equatorial regions of the world; nevertheless, its characteristics and nature from the point of view of genetic pedology are almost unstudied, in particular it is even unknown, whether it is formed under the herbaceous, or under the tree vegetation.

TE. *Degraded red-soil.* Hor. A, 20 cm. thick, of brownish-grey colour, friable, in the lower part nodular structured. Hor. B, 20 cm. brownish-orange, indistinctly nodular in structure. Hor. C, 35 cm., orange with brown or tawny-brown spots and veins, cloddy, dense. Under it lies the hor. B of the former red soils. Described by Prof. ZACHAROFF in Georgia near Batoum (9).

TF. *Ash-like red soil,* Hor. A, 4 cm. thick, straw-colored, grey, friable, structureless; hor. B, 30 cm. thick, in the uppper part whitish, slightly nodular in structure, friable, in the lower part whitish-yellow structureless, compact; hor. C, 40 cm. thick, dark brown with red spots, structureless, dense. Under it lies the hor. B of the former red soil. In hor. B and C occur Ortstein particles. Described by Prof.

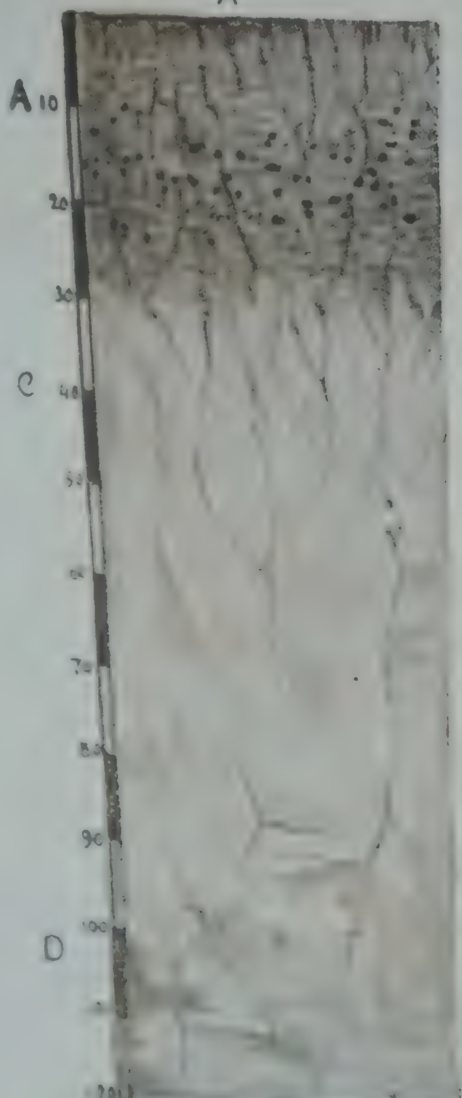
By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

genic division

P

Temperate zone

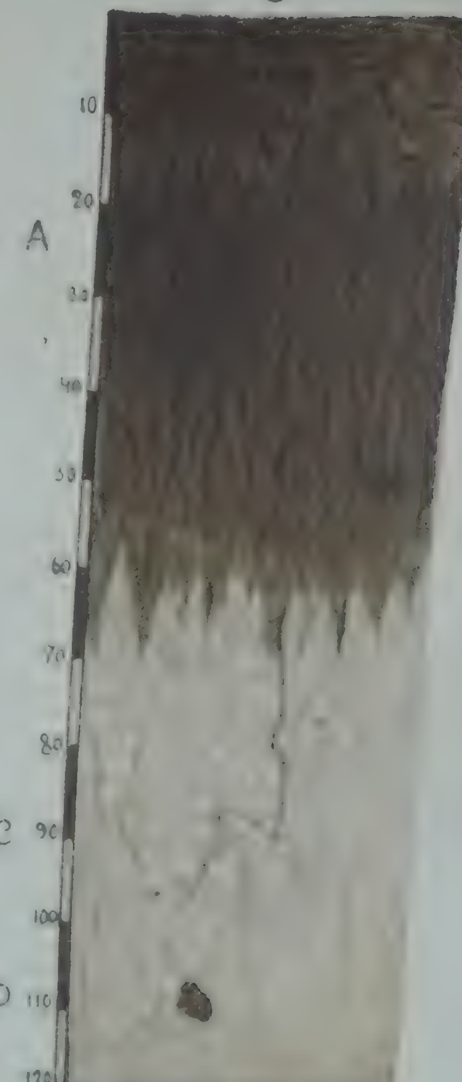
A



B

Brown soil

C



THE PRINCIPAL SOIL - TYPES OF THE WORLD. PLATE XCVIII.

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

Phytogenic division

P

Temperate zone

D

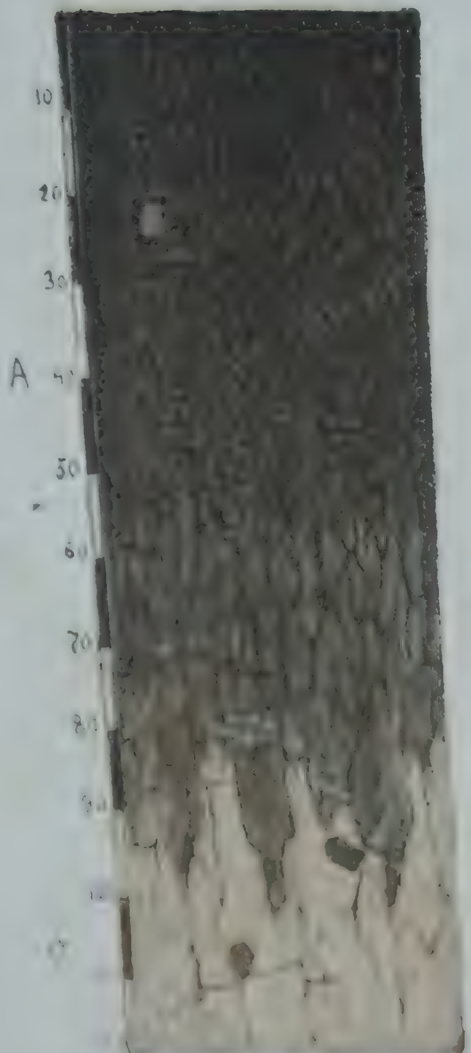


FIG. 273

Black soil

E

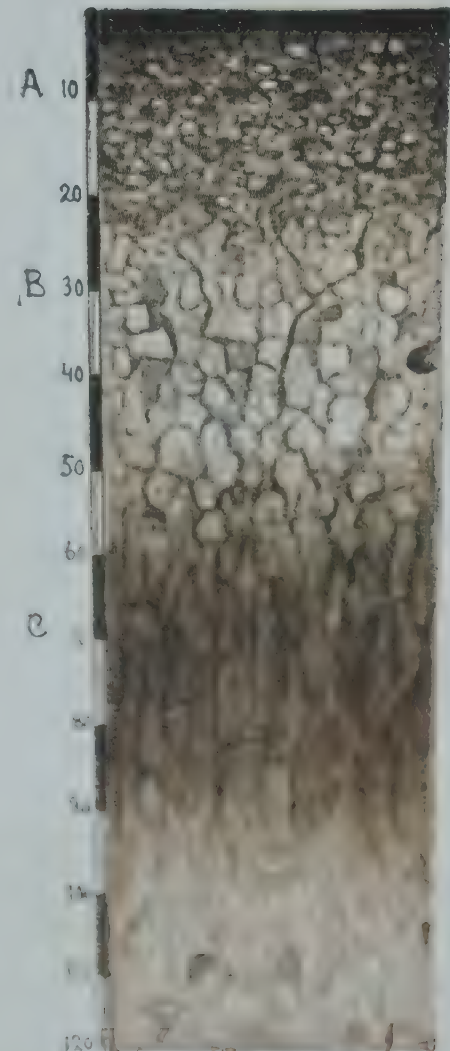


FIG. 274

Grey nodular soil

F

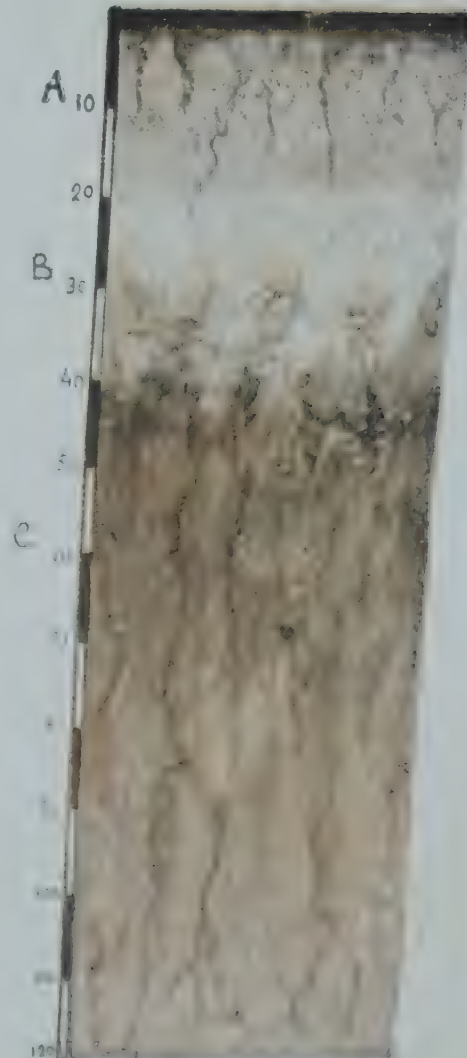


FIG. 275

Ash-like soil

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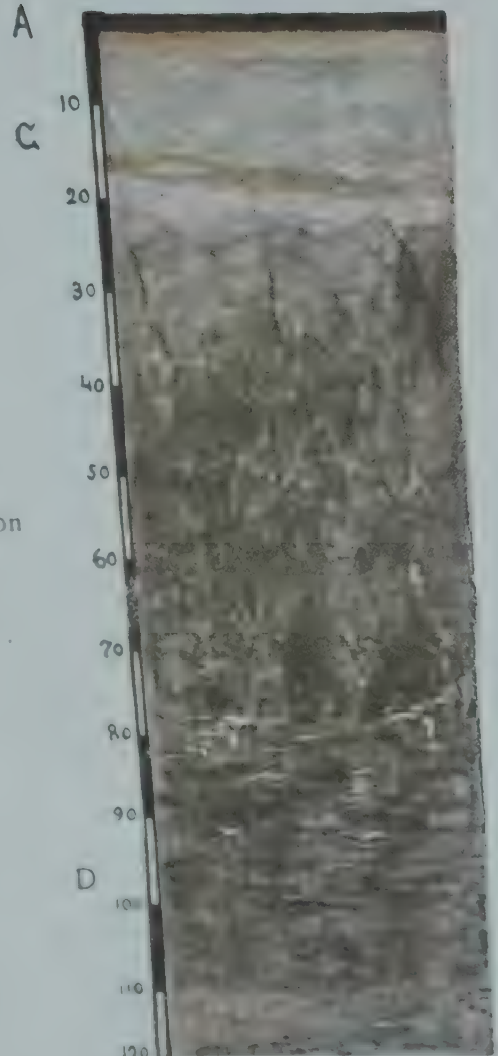
Hydrogenic division

H

Cold zone

A



Tundra soil

B

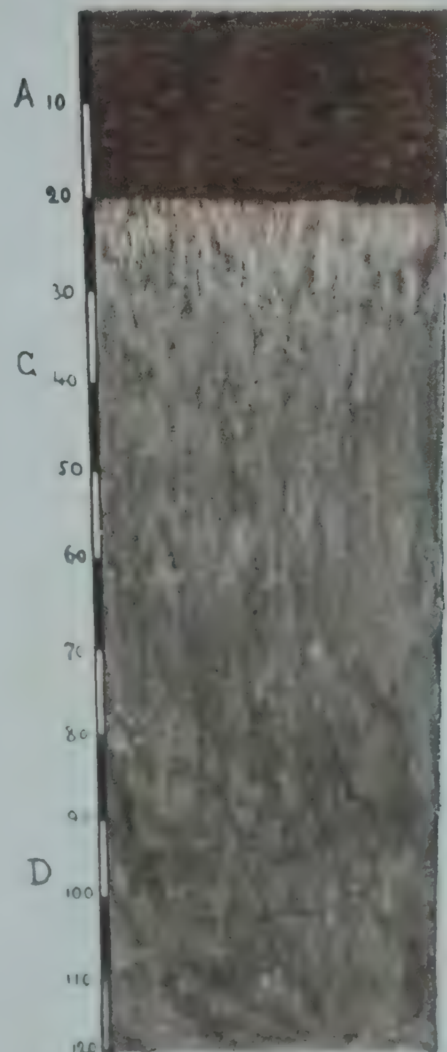


FIG. 277.

Half bog soil.

C

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

ogenic division

H

D

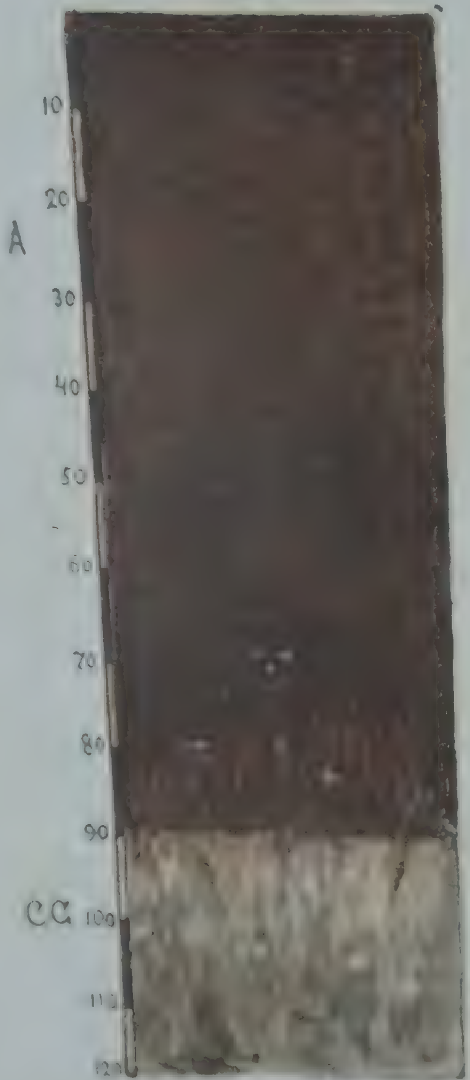


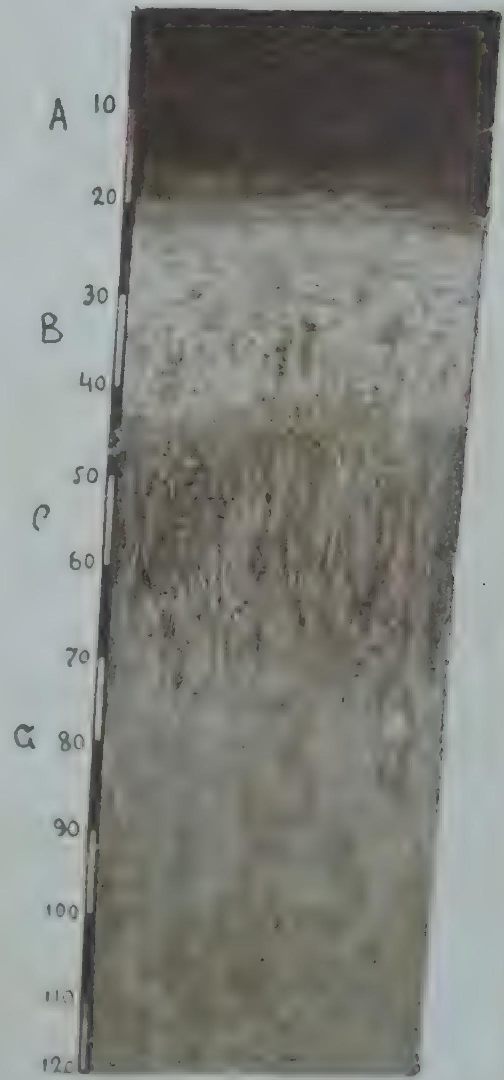
FIG. 279

Bog soil

E

FIG. 280

F



ZACHAROFF in Georgia near Batoum, but there are indications, as to its distribution in many parts of the torrid zone.

II. Phytogenic division.

PA. *Grey soil.* Hor. A about 30 cm. thick, light-grey with whitish-yellow, or brown tint, scaly in structure, with a great number of insects and worm tracks. Hor C 50-100 cm. thick, whitish, very dense, carbonate in upper part, in lower part has veins of gypsum. Effervesces on the surface. This type is zonal in the half deserts of the temperate zone and is distributed in Spain, Turkey, East-Transcaucasus, Persia, Turkestan, Mongolia, the Far West of the United States, Brazil and Argentina.

PB. *Brown soil.* Hor. A, 30-40 cm. thick, brown coloured, slightly foliated in upper part (A) more dense and slightly vertically clefted in lower part (A_2). Hor. C, 50-60 cm. thick, whitish, strongly carbonaceous. Usually effervesces in hor. C. Is zonal in South part of arid steppes of temperate zone and is distributed in South-East of European Russia, in Kirgis-district, Hungary and Mongolia. Its distribution on the other continents has nor been studied.

PC. *Nut-brown soil.* Hor. A, 60-70 cm. thick, nut-brown coloured, in the upper part (A_1) slightly foliated, in the lower part (A_2) more dense, roughly cloddy with distinctly shown vertical clefts. Hor. C, sharply shown, pre-eminently carbonaceous, but frequently contains gypsum. Carbonates mostly as completely formed units, most often as white masses. Effervescing as usual in hor C. Zonal in northern part of arid steppes of temperate zone. Distribution: Hungary, Roumania, South Crimea, South-East of Russia, Southern part of Western Siberia to Altai, South Transbaikal and Manchouria.

PD. *Black soil* (chernoziom). Hor. A 70-100, even to 150 cm thick, in upper part (subhorizon A_1) black with greyish or nut-brown tint, granular structured, in lower part (A_2 beginning at the depth of 40-50 cm.) of lighter nut-brown colour and cloddy-prismatic structure, gradually passes into the next hor. often in tongues, or in streams. Hor. C is rather distinctly shown, consists of sharply formed limy concretions. Effervesces in C. Zonal in northern part of steppes of temperate zone, distributed in Poland (Galicia). Hungary, Roumania, European Russia, West Siberia to Baikal, South Transbaikal United States of America (on the prairies) plateaus of the Far West, and in Argentina.

PE. *Grey nut-like soil.* From above, a forest cover 2-5 cm. thick, under it the hor. A 25 cm. thick, grey, finely nodular in structure. Hor. B 20-30 cm. thick, greyish, or ash-brown with grey silica and dark humus patches; of coarse nodular structure, becoming coarser towards the lower part. The surface of nodules is mealy, silicious, speckled. Hor. C to 100 cm. and lower, reddish brown, very dense, with vertical clefts and dark brown streams over them; 200-120 cm. deep, frequent limy concretions. Distributed under leaved woods in zone transient between forests and steppes — in Eurasia: Poland, European Russia, West Siberia to Baikal.

BF. *Ash-like soil* (Podzol). From above, a forest cover to 5 cm. thick, underneath, hor. A 10-15 cm. thick, light-grey, thinly granular, friable. Hor. B, 15-25 cm. thick, whitish or completely white, slightly foliated, light with misty-brown Ortstein particles. Hor. C, reddish-yellow, with numerous Ortstein particles, very dense, mostly structureless Distributed in forest districts of Eurasia, on other continents unstudied.

III. Hydrogenic division.

HA. *Tundra soil.* Hor. A-3 cm. thick, grey-brown, consists of humus partly, with some decomposed plant residues. Beneath it lies the hor. G (10) 8-10 cm. thick, of dove-grey colour, very sticky.

It is distinctly separated from the hor. A and D by a yellowish-brown ochreous layer 2-3 cm. thick. Hor. D is compact, brownish-grey, not flowing. At a depth of 79 cm. the permanently frozen layer is often found. This type forms the soil cover of the dry tundra, but its nature and the conditions of its distribution have been scarcely investigated. Described in the tundra of Asiatic Russia by Profs. SUKACHEFF (11) and DRANICIN.

HB. *Half-bog soil.* Hor. A to 20 cm. thick, brownish-black, more or less turfy, distinctly separated from the underlying layer. Hor. G. of varied thickness (15-20 cm. and more), dove-grey with greenish or bluish tint, with brown and rusty spots and veins. This type is usually considered as intermediate between marshy and not marshy soils and has been very little investigated. Largely distributed in the tundra and in the north part of the forest-zone.

HD. *Bog soil.* Hor. A 80-90 cm. thick, in upper half brown-coloured, turfy, in the lower (subhor. A_2), black, rich in decomposed organic matter, abruptly passes into the next layer.

alogenic division

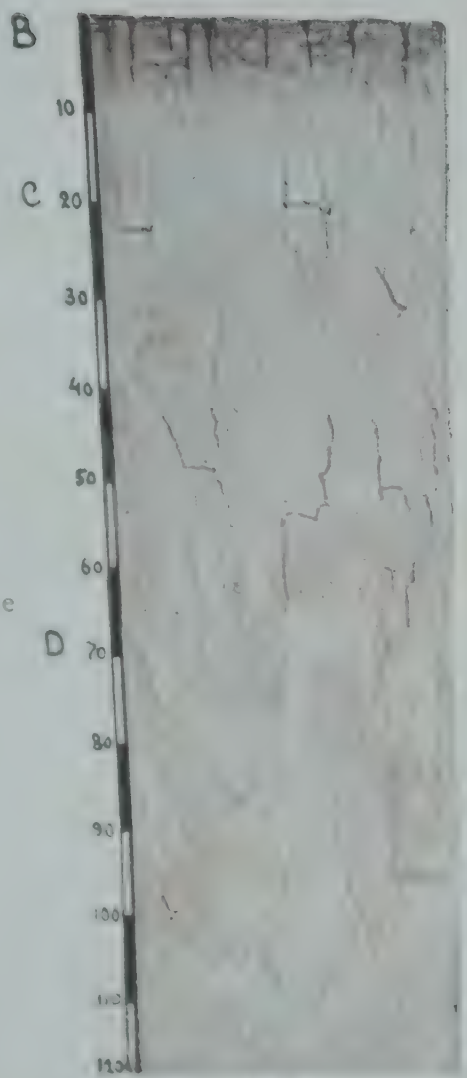
G

azonal in temperate

THE PRINCIPAL SOIL - TYPES OF THE WORLD.

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

A



B

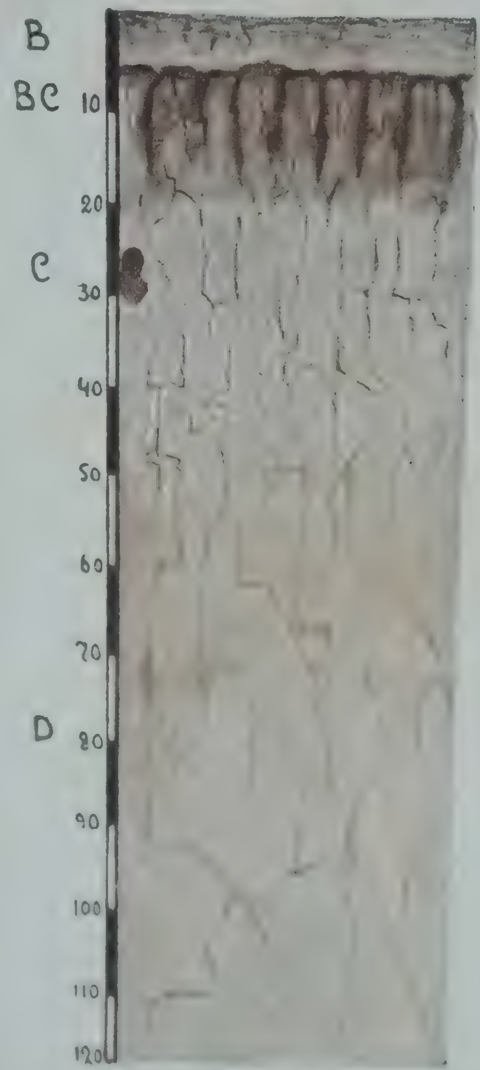


FIG 283

C

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

lalogenic division

G

razonal in temperate

D

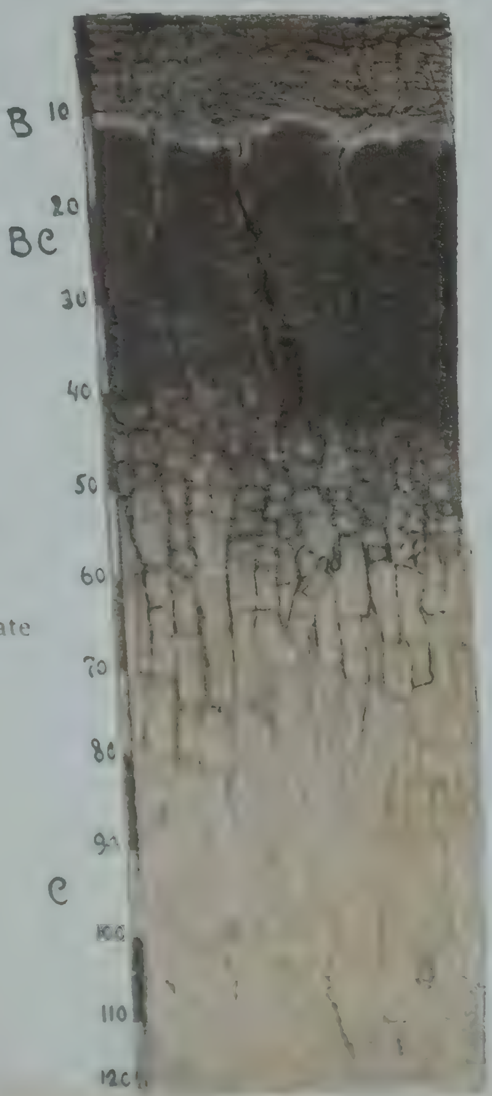


FIG. 285

E

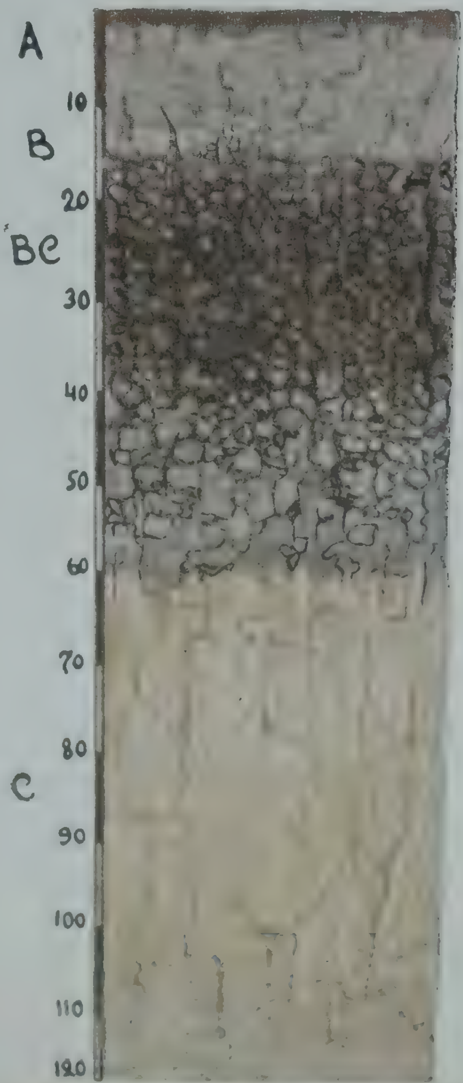
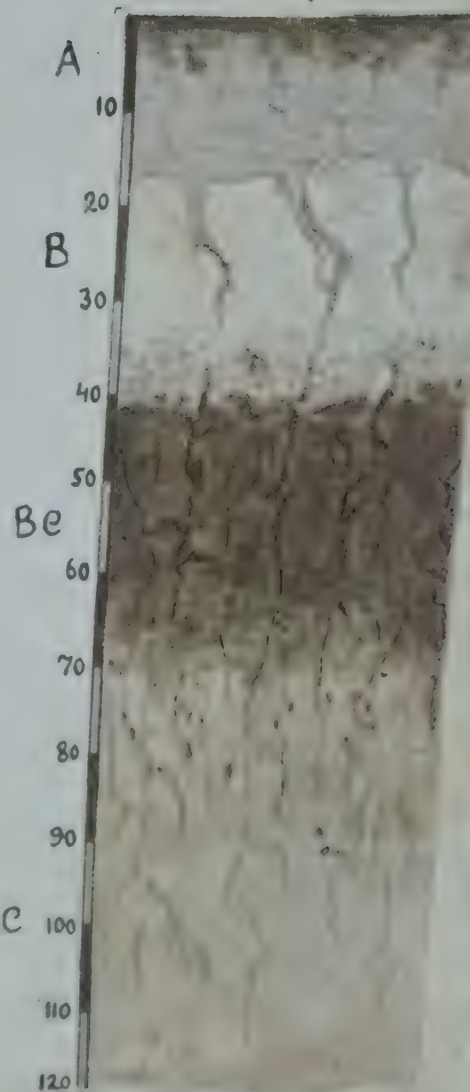


FIG. 286

F



Hor. G, of varied thickness, greenish or bluish, with a great number of patches and veins of hydrates of oxides of iron. Largely spread in tundra and in the forest zone.

HE. *Ash-like bog soil.* Hor. A, 20 cm. and more thick, black, half-turfy, in the lower part somewhat lighter coloured and less turfy. Hor. B, 20 cm. thick, dirty-grey, with dark humus patches and compact Ortstein particles, 1-2 mm. in diameter. Hor. G, sticky, dove coloured or greenish, with rusty spots, veins and Ortstein particles. The common type of soil-cover in the north part of the forest zone of Eurasia.

The soils of the hydrogenic division have been in general very little investigated and the types HC and HE were hitherto unknown in this division.

IV. Halogenic division.

GA. *Dry salt soil.* No hor. A. On the surface of the hor. B a very dense porous crust, smooth from above, as if polished, divided by a net work of clefts into parquetry-like partitions. Downwards it acquires a rather distinct scaly and flaggy structure The whole of hor. B is 10 cm. thick. Hor. C, without signs of infiltration, gradually passes into the hor D. Effervesces on the surface. To this type belong the dry salines — "takyri" — (in Kirgiz) of the semi deserts of Turkestan.

GB. *Prismatic alkaline soils.* Hor. B, 1-7 cm. thick, light-brown, leafy structure, friable, porous. Hor BC, 10-15 cm. thick, breaks into pieces of prismatic form, which are easily divided into small clods. In colour, light tawny-brown, is a little darker, than the previous layer, better shown on the sides of the prisms. The density of hor. BC is considerable. Hor. C contains veins and patches of salts not effervescing, Effervesces from the surface. Hor. BC mostly does not effervesce. Distributed in the south of the arid steppe zone of Eurasia among the light-brown and partly brown soils.

GC. *Pillared alkaline soils.* Hor. A of insignificant thickness (1-5 cm.), often completely missing, light-brown, chestnut coloured or tawny-brown, porous, always covered from above by a thin (1-2 mm.) crust, which cracks on drying into small polyhedrical flags. Hor. B 2-15 cm. and more thick, light whitish, mealy, distinctly foliated horizontally Hor. BD distinctly separated from the previous one, very compact, dark nut-brown, falls to pieces in the form of

pillars with a rounded top, 8-13 cm., high and 4-5 cm. thick. Downwards, hor. B grows gradually lighter becomes cloddy, nodular in structure and passes imperceptibly into C. Hor. C. distinctly alluvial, speckled with patches and veins of chlorides, sulphates and carbonates. Effervesces in hor C. Distributed in the region of nut-brown and brown soils of the steppes zone of Eurasia.

GD. *Black pillared alkaline soils.* Hor, A 6-12 cm. thick, black-coloured, foliated, friable. Hor, B 1-6 cm. thick, sometimes absent, light-grey or whitish, distinctly lamellar, porous, rather dense. Hor. BC 55-60 cm. thick, in the upper part consists of very compact polyhedrical pillars 10-15 cm. high and of the same thickness, with rounded tops. The colour of the pillars is intensely black, but from above and along the cracks they are covered with a thin whitish crust. Downwards, the hor. BC gradually grows lighter and in patches and tongues passes into C. Its structure is here nodular. Hor. C has distinctly shown signs of infiltration, as spots, veins and concretions chiefly those of lime. Effervesces at the depth of 35-40 cm. Distributed in the black soil zone of Eurasia.

GE. *Nodular alkaline soil.* Hor. A 10-20 cm. thick, dark-grey, generally structureless, rarely feebly foliated, rather friable. Hor. BC 50-60 cm. thick, composed of dark nodular clods with sparkling sides. Hor. C carbonate, structureless. Found only in the north part of the black-soil zone of West Siberia, where it is considerably distributed.

GF. *Ash-like alkaline soil.* Hor. A 17 cm. thick, in the upper part dark grey, deeper grey or whitish, friable. Hor B 11-25 cm. thick, compact, pillared, almost white, in the upper part finely foliated, in the lower part containing small brown clods. It contains many Ortstein particles especially in the lower part. Abruptly passes into the next horizon. Hor. BC 25 cm. and more thick, dense, dark, greyish and rusty-brown, falls into pieces of prismatic form, contains a great quantity of ochreous spots and grains. Hor. C structureless, rich in ochreous-rusty accumulations ($Fe_2O_3 . H_2O$). No effervescence. Distributed chiefly in the zone between forest and steppe, under birch and aspen forests, but also in the steppe-zone in low-lying areas.

The soil types in their turn are divided into smaller classification units: (1) subtype, (2) group, (3) variety.

The *subtype* characterizes the degree of the soil-forming process in the given type; the character of the *group* depends on the structure of the mother rock; *variety* depends on the composition of the fine

earth of the soil. In consequence, it is possible to continue the classification scheme in that way. (Tab. No. 2).

As no detailed appreciation of the proposed classification is entered into (12), we will only note the advantages which it has in comparison with the other existing classification of soils.

(1) It is *genetic* in the literal sense of this word, because it is based on the difference in the genesis of soil, while the greater part of other classifications proposed by Russian pedologists are *geographic*, as they took for a basis the distribution of soils.

(2) Being very simple, it is at the same time sufficiently wide and comprehensive, including a considerably larger number of types than has been described until now. Moreover it can be extended, or shortened without any difficulty, so that an augmentation or a diminution of the number of divisions and even of rows will produce no breaking either of principles of construction, or of the scheme of the classification itself.

(3) The disposition of soil under the form of a *periodical system* shows which types are not yet described, evokes the necessity of searching for them and gives the possibility to foretell their nature.

(4) The important advantage of the proposed classification is that it gives *the possibility to adopt a conventional designation of soils by alphabetical symbols under the form of soil-formulas.* We find that it is unnecessary to stress the importance of introducing into a concretely-descriptive classification the designation of described bodies by formulas. In Russia, particularly, has been felt long ago the inconvenience of the designation of types by composed words, which often becomes not a designation, but entirely a description of the soil. It appears also, that the same inconvenience is felt by Western European and American pedologists, who begin to use for designating certain types the foreign names. Therefore the introduction of an international language into soil-investigations becomes a pressing necessity. The simplest and most intelligible language in science is that of formulas. The principle of the construction of soil-formulae on the basis of the above mentioned classification is very evident. As was already shown the symbols of a type are two (in the intermediate divisions three) letters: a letter of the division and that of the series. The addition of the index 1, 2, 3, to the letter of the series designates the subtype. The group is designated by small letters *a-f* and the genesis of the mother rock by the addition of the index

Type		Brown	Nut-Brown	Black soil	Grey nodular soil	Ash like soil	Bog-soil
Sub-type	1	Light brown	Light nut brown	Southern	Degraded black soil	Slightly ash like	Slimy
	2	Brown	Dark brown	Common	Dark grey	Ash-like soil	Turfy
	3	Dark brown	Dark nut brown	Heavy	Light grey	Ashy-soil	—
		On alumino-silicate fine earth rock *a*	On carbonate fine earth rock *b*	On quarz-sandy fine earth rock *c*	On alumino-silicate skeleton rock *d*	On carbonate skeleton rock *e*	On quarz-sandy skeleton rock *f*
Group	1	Crystalline					
	2	Sedimentary					
	3	Moraine					
	4	Loess					
	5	Diluvial					
	6	Alluvial					
	7	Eolic					
Variety	1	Loamy					
	2	Clayey					
	3	Clayey sand					
	4	Sandy					

1-7 to those letters. The variety is designated by the figures 1-4 in front of the letters (the figure 1 is omitted).

Formulae:	designation:
$2P_3Cb_5$	Clayey, dark nut-brown soil, on the carbonate fine-earth diluvium.
$2\ P_2D_4b$	Clayey, common black soil on a carbonate fine-earth loess.
PHF_3a_3	Loamy, ashy-soil, on a alumino-silicate fine-earth morena.
$2TFd_1$	Clayey, ash-like red soil, on an alumino-silicate, crystalline skeleton rock.
GCb_2	Loamy, pillared, alkaline soil on a sedimentary carbonate fine-earth rock.
$4PHF_3c_7$	Sandy ashy-soil, on a quartz-sandy fine-earth, eolic rock.
$2HGAb_6$	Clayey chloride-sulphate, salt soil, on a carbonate, fine-earth alluvium.

The above formulae, already simple, can be further simplified in accordance with the character and object of the investigations. In a brief description it is enough to mention the type and the variety, for instance, 2PD = Clayey black soil, PF = clayish-soil, etc., without indicating the subtype and the group, which requires a more thorough knowledge of the soil.

Summary.

1. *The soil* is a particular body of nature, extending like a fine epithelium over the surface of the lithosphere and forming *the pedosphere*, a particular cover of the terrestrial globe. *The pedosphere is the exterior horizon of the lithosphere, modified by the mutual interaction of the atmosphere, biosphere and hydrosphere.*

2. The soil is a product of the action of soil-forming agents, to which it is bound by functional dependence.

3. There are four fundamental soil-forming agents: *lithosphere*, *atmosphere*, *biosphere* and *hydrosphere*, the first being *passive* and the three others *active* agents of soil-formation.

4. The various modifications of the agents themselves as well as their combinations is the cause of variety in soil-formations.

5. This variety is largely connected with the external conditions, the principal of which are the *relief* and the duration of the influence of soil-forming agents (*the age of the soil*).

6. In different climatic zones of the world all the agents enumerated are not equivalent and the dominance of one of them over the others is quite obvious. In *the torrid zone* the chief soil-forming agent is *the atmosphere, in the temperate zone the bio-*, or to be more exact, *the phytosphere, in the cold zone the hydrosphere, the litosphere being an intrazonal agent.*

7. In accordance with the dominance of one or other agent, it is possible to establish four fundamental divisions of soil-formation: *thermogenic, phytogenic, hydrogenic, halogenic* and six intermediate divisions.

8. Within the limits of every division the soil passes through a definite cycle of development, *progressive*, until the moment of maximum expression of its properties and, *regressive*, from the moment of its beginning to decompose into more simple integral parts. The fundamental stages of this cycle are called *types*.

9. The *type* is the fundamental unit of the classification of the soil-cover.

10. The types in all divisions are disposed in *analogous series*, which makes it possible to construct the classification of soils on two coordinates, similar to a periodical system.

D. Vilensky,
Karkow.

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Zacharoff S.: *Bul. of Polytechnic Inst. of Tiflis* v. 1, 1924.
(5) Gedroiz, K. K. *Journal of Exper. Agronomy*, v. XIII, 1912.
(6) Glinka, K. *Pedology*, 2 edit. 1915, 354 p.
(7) The Russian pedologists distinguish in soils several genetic horizons, which they designate by letters, namely: A, *accumulative* hor., in which takes place preeminently the accumulation of organic matter (humus), B, *illuvial*,

in which organic matter, bases (R_2O and RO) and oxides of iron and aluminium (R_2O_3) are washed away, and which in consequence is rich in silica (SiO_2) ; C, *alluvial*, in which are found the materials washed out of the upper horizons (A-B) ; D-representing an horizon unchanged by the soil-forming processes, which is called *maternal rock, subsoil* or *ground*. The horizons in their turn are divided into sub-horizons (A_1, A_2, A_3 ; B_1, B_2, C_1, C_2, etc.

(8) DRANICIN, D. *loc. cit.*

(9) ZACHAROFF, *loc. cit.*

(10) Russian pedologists designate by the letter G the horizon of bog soils ("gley ") in which take place de-oxydating processes and in which are formed protoxide compounds.

(11) SUKACHEFF. *Bul. Ac. St-P.* 1911, No 1, 51 p.

(12) The detailed explanation is given in the Russian work . " The Analogous Series in Soil-formation and their Importance for Construction of Genetic Classification of Soils ". By Prof. D. VILENSKY, Tiflis, 1924.

Abstracts and Literature.

Soil Physics.

Some Factors influencing the Impermeabiilty of Soil.

BOTKIN, C. W. Paper read before the New Mexico Association of Science (Chemist, Agricultural Experiment Station, State, College New Mexico). November, 1924.

A new cause for the infertility of certain lands has been discovered. This cause is impermeability to irrigation water. Such infertile soils are hard and dry a short distance below the surface even though water is held on the land for several days. This condition develops in some irrigated soils, which were formerly fertile. The soils are not deficient in plant food, but tend to accumulate alkali, since the irrigation water evaporates without percolation.

It was thought that the impermeability might be caused by deflocculation of the soil colloids produced by basic exchanges in which sodium and potassium of the irrigation water displaced calcium and magnesium from the soils. The soils were found to be high in calcium and magnesium and the ratios of divalent to monovalent bases in the irrigation and drainage water were not such as to strongly support this hypothesis.

Sodium chloride, sodium sulphate, and sodium silicate caused soils to become practically impermeable. Aluminium sulphate, tannic acid, calcium acid-phosphate, magnesium sulphate, manure, and gypsum were found to assist the penetration of water into the impermeable soil. The respective efficiencies of these materials, when one-half of one per cent. (one per cent. of manure) was mixed with a one foot column of the soil of low permeability, are represented by 4, 15, 17, 20, 22 and 23; where 36 represents the number of hours in which a one foot column of the untreated soil took in the first six inches of water. The maximum permeability obtainable with aluminium sulphate required between 0.5 and 1.75 per cent. of aluminium sulphate for the four soils studied. Very small amounts of aluminium sulphate caused marked improvement in permeability, indicating that impermeable soils may be profitably improved by treatment with aluminium sulphate. The increased permeability secured by aluminium sulphate was proved to be practically permanent. Aluminium sulphate up to 2 per cent. was not toxic when mixed with the soils studied, but became insoluble, displacing calcium as sulphate and bicarbonate.

After a five month's irrigation test the soils treated with aluminium sulphate had a porosity suggesting that gas might have formed in the soil and subsequently left in solution in the percolating water. The loosening effect of aluminium sulphate may be mechanical, similar to the baking powder reaction in the making of bread. The persistence of adsorbed air was found to be a factor in causing the impermeability of some dry soils. The cementing effect of calcium carbonate and other materials in solution in the irrigation water, where the soil moisture diminished to a very low value, was another factor contributing to the impermeability.

The study of permeability is being continued. X

Erosion and Surface Run-off Under Different Soil Conditions.

DULEY, F. L. and MILLER, M. F. *Missouri Agricultural Experiment Station. Research Bul. No.* 63, pp. 50, 1923.

Seven plots, each one-eightieth of an acre in area, were laid out on a phase of the Shelby loam soil. The slope of the land averaged 3.68 feet per hundred. At the lower ends of the plots were concrete tanks for collecting the run-off and eroded soil, which were determined after rain. The results of these experiments showed that grass or clover land absorbed much more water than cultivated land. Deep plowing (8 inches) was only slightly more effective than shallow plowing (4 inches) in preventing run off and erosion. The surface inches of rainfall absorbed by uncropped land, or land in a cultivated crop like corn, was practically constant from year to year, even with considerable variation in the annual precipitation. The character of the rainfall largely determined the amount of soil erosion. A heavy rain was observed to remove more soil within a few hours than was lost during a whole year when the rainfall was well distributed. The loss of important nutrient elements from the soil through erosion may often be more serious than the loss through the removal of crops. The use of a cropping system that includes sod crops a considerable portion of the time, is the most practical means of reducing erosion on rolling land.

AUTHORS.

Methods of Investigation of Soil Moisture.

KACHINSKY, N. A. 2 Ed. Moscow, 1924.

The soil as a body created by several natural processes, is composed of separate, more or less strictly differentiated parts or genetical horizons, and sub-horizons differing in their physical and chemical structure. The regulation of moisture properties depends, besides other factors, upon physical, chemical and other properties of the soil, inasmuch as these properties are different in separate horizons or even sub-horizons. The moisture will be more or less individualized in them. Therefore it is expedient to investigate the moisture regulations of the soil and its other properties according to the separate genetical horizons.

It may be supposed that in separate genetical horizons moisture must vary slightly and change gradually, and vice versa, in passing to the next horizon the change might be more drastic. This can be proved by observation. The following table No. 1 shows clearly that fluctuations of soil moisture are greater between different horizons, than between measurements belonging to the same horizon.

Date of observation	Depths of genetical horizons of the soil					
	A_2-26cm.	A_2-3[illegible]cm.	B_1-[illegible]cm.	B_1-50cm.	B_2-54cm.	B_2-73cm. B_3-76cm.
24-XII-1922	56[illegible]	5[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

This is particularly evident in relation to moisture when estimated for every cm. of soil depth. It appears that fluctuations in the upper horizon of sandy clay soil of a woodland soil are about 2½ times less than in passing from this upper horizon to the next sub-horizon of the first condensation (B_1). Likewise the fluctuations in B_1 are 20 times less then when passing from B_1 to B_2. Finally, for the two last sub-horizons (B_2 and B_3) this relation is 9.

The same kind of fluctuations, according to genetical horizons, are shown in their moisture equivalents.

It is evident that one has to study soil moisture along genetical horizons.

The maximum hygroscopic qualities and the moisture equivalents of soils change also rather abruptly according to separate genetical horizons. As both those properties serve as tests for valuation of the observed absolute data for soil moisture as to its utility for plant growth, we have to value these absolute data separately for each sub-horizon. This valuation might change the whole picture of moisture distribution, as the valuation might seem to have been made out according to the absolute data only.

Therefore, it must be assumed, that data for soil moisture, especially those concerning soils, strictly differentiated into their genetical horizons, have been obtained and arranged according to the generally recognized methods, without reference to the properties of separate genetical horizons.

The investigation on the vigour of the spreading capacity of the root system of rye, oats, and grasses, according to the different genetical horizons and sub-horizons of a sandy clay soil (of a woodland soil) shows that although the depth of the root system may be more than one metre, the chief mass of roots (about 90 %) is concentrated in the upper arable strata.

In reconciling this fact with observations of soil moisture on field plots occupied by those plants it must be pointed out that soil moisture is used by the roots of plants up to the full depth able to convey moisture by capillarity, but primarily the upper arable strata are exhausted of moisture. If the soil is subsequently moistened on the surface, a dry stratum can remain at some depth, whereas this depth and the extent depend upon previous drying and upon the amount of subsequent atmospherical precipitation. AUTHOR.

Soil Chemistry:

Chemical Properties of Soil.

BERTRAND, G. and MOKRAGNATZ, N. Sur la présence générale du Nickel et du Cobalt dans la terre arable. *Annals of agronomical science*, May-June, p. 167 to 171. 1925.

The authors have found from 5 to 30 mgm. of nickel and from traces up to 12 mgm. of cobalt in the soils of France, Germany, Italy, Denmark, Serbia, Rumania, independent of their geological origin.

Granitic sands appear to be the poorest.

The ratio Nickel to Cobalt, is generally from 3 to 5, but varies irregularly from 2 to 8.

PIERRE LARUE (*Gurgy sur Yonne*).

Determination of Phosphoric Acid.

BOISCHOT, P. Influence des sels de calcium sur le dosage volumétrique de l'acide phosphorique, *Annales de la Science agronomique*. May-June, pp. ...-202, Paris, 1925.

The quantity of free H_3PO_4 can be determined in liquids containing mineral acids, even in the presence of lime salts, by titration with alkaline liquid, using helianthine and phenolphthalein.

Helianthine will indicate the quantity of alkali necessary to saturate the strong acid, plus that necessary to saturate the first acidity of H_3PO_4.

The change to phenolphthalein will indicate the quantity of alkali required to saturate the strong acid, plus that needed to saturate the H_3PO_4.

PIERRE LARUE (*Gurgy sur Yonne*).

The Chemical Nature of a Colloidal Clay.

BRADFIELD, D. *Missouri Agricultural Experiment Station, Research Bulletin* No. 60, pp. 60. 1923.

The fresh subsoil of Putnam silt loam, the predominating prairie soil of North-East Missouri, was suspended in five parts of water by stirring the coarser material settled by gravity and the finest colloidal material was separated by means of a centrifugal force of about 30,000 times gravity. This fraction was unusually high in Al_2O_3 and Fe_2O_3, almost all of which was soluble in hot HCl, which indicated that the colloidal fraction might be made up largely of the completely broken down end products of weathering, viz., colloidal Al_2O_3, Fe_2O_3 and SiO_2. A synthetic mixture of these colloids having a chemical composition similar to the natural colloid was prepared and the physico-chemical properties compared. Cataphoresis studies showed that the natural colloid was negative and that the synthetic mixture was positive. The migration velocity of the natural colloid was decreased by traces of acids and increased by traces of alkali; larger amounts of alkali caused flocculation. In no case was the direction of migration reversed. The synthetic colloid had a much stronger buffer action than the natural colloid, due apparently to its high content of free Al_2O_3. The natural colloid was flocculated most readily by polyvalent cations in an acid medium. The synthetic mixture was more sensitive to polyvalent anions and to alkalis. Analyses were made of the fractions of each colloid soluble in dilute acid, and in dilute alkali. The differences were marked throughout. All data obtained indicated that the natural colloid was a complex alumino-silicate, rather than a mixture of the separate colloidal oxides.

AUTHOR.

The Examination of Peat Materials.

DACHNOWSKI, A. F. (Bureau of Plant Industry, United States Department of Agriculture). *Journal of Agricultural Research*. Vol. XXIX, No. 2, pp. 69-83, bibliography. Washington, D. C. 1924.

During the past few years investigations have been made regarding the different kinds of peat, and their position and arrangement relative to one another in different parts of the country.

From the results so far obtained it is concluded that an adequate description of peat land must recognize: (*a*) the differences in type of plot and the profile deposition of the material; (*b*) the water level in relation to the surface zone of oxidation and the lower zone of reducing action; (*c*) the nature of the subsoil and the water supply affecting the quantity and character of salts, such as lime, iron, sulphur, etc.

The results obtained with 20 different kinds of peat indicate the suitability of methods of foodstuff analysis for the investigation of qualitative differences in sedimentary, fibrous and woody peat materials. The value of these methods is limited, but they show that a close connection exists between the botanical and the chemical composition of the main groups of peat. The chief groups of organic compounds may be correlated with structural differences in the profile of peat deposits; the progress of the decomposition in drained surface peat soils may be followed, and the degree of chemical alteration taking place in the layers of peat below the water level may be determined.

The analyses show the wide differences in agricultural value of the several kinds of peat. W. S. G.

Removal of Lime from the Soil.

DEMOLON, A. Décalcification des sols. Laon, *Bull. Ass. d'Anc. élèves — Institut National Agronomique*, pp. 185-187. Paris, 1925.

Arable land loses every year from 600 to 1000 kg. of lime (CaO) per ha. Fertilizers, in particular slags, add lime but only in small quantities. The treatment of weeds with sulphuric acid increases acidity.

The treatment recommended is that with ground chalk in amounts of 800 to 4000 kg. per ha., rather than with free lime, the use of which causes the acid reaction to change to a caustic alkaline reaction.

From the physical point of view, lime and chalk have great capacity for flocculating clay, then come calcium nitrate, potash salts, ammonium salts and lastly soda salts. PIERRE LARUE (*Gurgy sur Yonne*).

Quaternary Alluvial Deposits.

DEMOLON, A. Sur la texture des limons quaternaires et des sols qui en dérivent. *Académie des Sciences*, meeting of 9 March, Paris, 1925.

This paper dealt with samples of clay from the North of the Oise at Montbrehain, Bohain, Bellicourt and Lequchart, lying on brick earth and then on ergeron to a depth of 120 to 150 metres.

The mechanical analysis by levigation (Kopecky method) is as follows :

	Sand 0.4 mm. to 0.2 mm.	Sand 0.2 mm. to 0.05 mm.	Silt 0.05 mm. to 0.02 mm.	Silt 0.02 mm. to 0.005 mm.	Clay from 0.005 mm
Arable land	7.7	12.7	44	30.6	2.1
Brick earth	4.4	8.6	45.7	29.6	10
Ergeron	5.0	8.3	48.0	28.2	8.8
Red clay	3.0	10.2	[illegible]	[illegible]	[illegible]
Plastic clay[1]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Plastic clay is Tertiary (Sparnatian). The origin of ordinary clay must be connected with this formation and not with the sands of Laon and Fère.

The washing out of lime from the surface layers of arable land has allowed the removal of clay. The plasticity of this soil is due, not to the proportion of plastic clay but to the large proportion of fine clays.

PIERRE LARUE (*Gurgy sur Yonne*).

Composition of Brick Earth.

DEMOLON, A. C. R. Sur la constitution chimique de la terre à briques. *Académie des Sciences*, Paris, 1925.

The author has compared brick earth and ergeron, belonging to the diluvium of the North of France.

He has found no difference, except perhaps in the colour and the proportion of iron oxide, which is respectively from 0.70 and 1.25 in brick earth, as against 0.45 and 0.90 in the underlying ergeron.

Limonite investing the sandy elements constitutes a stain which is fairly easily washed out by water.

There are no bases as in loess, no free aluminium, nor laterite formation. Hence, a simple phenomenon of the washing out of lime followed by oxidation of iron through atmospheric agency.

PIERRE LARUE (*Gurgy sur Yonne*).

Easily Soluble Calcium of the Soil in Relation to Acidity and Return from Liming.

DULEY, F. L. *Soil Science*, Vol. XVII, pp. 213-228, 1924.

Comparisons were made between the amounts of calcium present in different forms in soils and the results obtained in the field from applications of lime. No definite correlation was found between the calcium content of the displaced soil solution and the need for liming. This was due in part to the great variation in the soil solution under different con-

ditions. The calcium soluble in 0.04 N carbonated water, averaged only 553 pounds per acre in the soil from seven experiment fields in Missouri and Wisconsin, where good returns were obtained from liming. The amount was 810 pounds per acre as an average of seven soils that did not give good returns for liming. Since the average acidities of these two groups of soils were approximately the same, the soluble calcium seemed to be a more accurate index to the need for lime than the acidity. Soils of approximately the same acidity varied widely in their soluble calcium content. Marked increases for lime occurred chiefly on relatively infertile soils, but one infertile soil high in soluble calcium gave only slight returns from liming. The carbonated water extracted on the average 0.32 per cent. of the total calcium in the soils studied. AUTHOR.

Base Exchange in Soils.

HISSINK, D. (*Trans. Faraday Society*. see *Zeitschrift für Pflanzen Ernähr. und Düngung*. 4 A, 1925, 137 (Der Sättigungzustand des Bodens. A. Mineralboden (Jonboden).

Certain acid radicals are known to be absorbed by soil more readily than others. Treatment of soil by acid (I) removes absorbed bases, (II) may eventually destroy soil colloids, (III) only in extreme cases destroys structural minerals. Evidence is given in favour of removal of acid radicals, by formation of insoluble salts rather than by adsorption (RUSSELL and PRESCOTT). Only those radicals are removed which form insoluble salts with one or other of chief soil bases. The cycle of changes on adding a salt of one of these acids is, base exchange — liberation of free acid — formation of insoluble salt.

Experiments show that the oxalate radical is only absorbed in the presence of a high concentration of Ca. Soils previously extracted with HCl show no absorption, because insoluble Ca oxalate cannot be formed. Soil phosphates are more soluble in short time extractions of mineral acids than in 24 hour extractions.

The normal cycle of changes is, easily soluble phosphates dissolve in acid — sparingly soluble Fe and Al brought into solution later — precipitation of insoluble Fe and Al phosphates. The amount of phosphate absorbed by soil from a solution of Na_2HPO_4 in varying concentration of HNO_3 increases to a maximum and then falls off as the concentration of HNO_3 increases.

The effect of non-diffusible Al ion is shown by the distribution of H and anion concentrations in a system composed of soil in a diffusion capsule with dilute acid inside and out. H ion concentration increases outside and anion concentration inside. The same effect is produced with soil saturated with acid, with salt solution as a supernatant liquor.

On the basis of such observations, the toxic action of aluminium salts is explained as a result of high H concentration in the cell sap and high anion concentration in the surrounding soil, with consequent interference with the transpiration current and intake of nitrate, etc. T. E.

Absolute Capacity, for Air and the Degree of Acidity, of Forest Soils.

KNAPIL, K. and NEMEC, A. Sur la relation entre la capacité absolue de l'air et le degré d'acidité des sols forestiers. *Académie des Sciences*, Paris. 1924.

The nature of forest soils depends not only on the mother-rock, but also on the type of trees grown.

The authors made more than a hundred physical analyses in the forests of St. Markyta, Jindriche and Zavratec-Tremosnice in Bohemia, all on primary strata.

They determined the acidity by the potential hydrogen (inverse P_H) and the absolute capacity for air, that is, the total volume of the pores of the soil which, after saturation of the soil by water, still remain filled with air.

Amongst conifers: fir, spruce, pine, from 40 to 90 years old, the P_H varies from 4.5 to 5, and the air capacity from 14 to 38.

Amongst deciduous trees: beech, oak, ash, the P_H varies from 5.7 to 6.7 and the air capacity from 23 to 45 per cent.

In mixed plantations of deciduous and resinous trees, for example beech spruce, spruce and oak, intermediary figures are obtained.

The absolute air capacity of closely planted trees with non-deciduous leaves is lowest and decreases with the increase of acidity of the soil.

If the plantation is thinned out, the capacity becomes higher.

In the soils of deciduous forest plantations, the absolute air capacity is higher than for the fir and the spruce. The soils are less acid.

PIERRE LARUE (*Gurgy sur Yonne*).

Experiments on the Control of Wart Disease of Potatoes by Soil Treatment, with Reference to the Use of Sulphur.

ROACH, W. A., GLYNNE, Mary D. BRIERLEY, W. B. and CROWTHER, E. M. *Annals of Applied Biology* 1925, XXII, 152-190.

On light sandy soil contaminated with Synchytrium, it is possible to obtain a clean crop of a susceptible variety of potato by incorporating about 12 cwt. of ground sulphur per acre into the soil. On heavy soil up to 2 tons of sulphur per acre is required to destroy the fungus. These amounts are considered uneconomic on a field scale. P. H. H. GRAY.

The Injurious Effect of Excessive Liming on Podsol-Soils in connection with the Peculiar Character of the Biological Processes, taking place in such Soils.

TINLIN, A. *Transactions of the Institute of Fertilizers*, No. 26, p. 1-143 Moscow 1925.

In order to investigate the causes of the injurious effect of excessive amounts of lime introduced into the soil, experiments were conducted in 1923, in addition to those made in 1922.

FOREWORD

The index arranged alphabetically is divided into three sections: 1) original articles; 2) agricultural intelligence; 3) plant diseases: Lists of authors are also included.

The index has been compiled by Miss M. L. Yeo

I. — ORIGINAL ARTICLES

salts did not exceed 0.05 %. The analysis was not made in this case, because of the sustained coloring of the washings.

(8) Small quantities of lime, not exceeding 0.2 % did not bring about any decrease of yield on the same light soil, on which there was reduced growth of plants after the application of 1 % of lime. The amount of the products of biological processes, especially the amount of ammonia, was found to be much smaller in this case than after excessive liming.

(9) The accumulation of nitrites, noted in 1922 in the case of a marked retardation of plant growth, brought about by excessive liming, was not recorded in 1923, when the decrease in crop yield was also less marked than in the previous year.

(10) Different kinds of plants do not exhibit the same degree of sensitiveness to the injurious effect of excessive liming. Besides, this sensitiviness is dependent upon the age of the plant, being very great in the early stages, of its growth and becoming less pronounced in a more advanced period of its life. AUTHOR.

Liming of Soils in France.

Enquiry on liming and the best methods of developing this practice.

Enquête sur le chaulage et les moyens propres à développer la pratique de cet amendement. *Bulletin du Ministère de l'Agriculture* (Office des Renseignements), 5 pp. May, July, 1925. Paris, 1925.

REGION I: NORTH.

Département du Nord. — The silts and clays of Flanders are poor in lime, the percentage being 0.5 to 2.5 per cent. Little liming is done.

Pas-de-Calais. — The Jurassic clays of the Bas-Boulonnais, the siliceous clays and the alluvial soils of the plateaux are deficient in lime. The marine alluvial soils of the Calaisis (the Watringues) have adequate lime. Marling is no longer done as before with chalk.

Somme. — Lime everywhere in the sub-soil: marly loams. In the Arménois, chalky plateaux. In the Santerre, plateau clay from 6 to 8 metres in depth: friable soil suitable for beets, with at least five per cent of lime.

Vimon et Ponthieu. — Siliceous clay, red, poor in lime (5 %), more or less covered over with plateau clays.

Marquenterre and Bas-Champs. — Sandy marine alluvial deposits containing less than 2 per cent. of lime.

All the valleys of the Department of the Somme are peaty.

Aisne. — Clays, brick earth, ergeron, red clay of the Vermandois and of the Soissonais: the argillaceous soils of the Marlois, the Vervinois, the Tardenois, or three-fifths of the lands under cultivation with industrial crops in the department, an area of 350,000 hectares, are only slightly or not at all calcareous.

Marl is supplied from the chalk or limestone lying immediately below.

Oise. — The less calcareous regions are — 1. Valois, 2. Moyonnais, 3. the east of the Picardy plateau which is covered with clay or with flinty clay on the South. The lime content is from 1 to 4 per cent.

Seine et Marne. — Proportion of lime according to the geological strata.

Eboulis: 0.3 to 13: average 1 to 2 per cent.
Recent alluvial deposits: 1.9 to 25, average 8 to 12 %.
Plateau clay: 1 to 8, average 2 to 3 %.
Fontainebleau sand: 0.1 to 2, average 1 %.
Mussel clay and marls: 0.2 to 4, average 3 to 5 %.
Green clay: 0.9 to 67, average 15 %.
Champigny travertine: 1.5 to 39, average 9 to 10 %.

A basin of Jurassic soils and clays, all grass land, and without lime.

Seine Inférieure. — The majority of the soils of the country of Caux, chiefly flinty clay, only contain 3 to 5 % of lime. Chalk is extracted from under the clay.

Eure. — Even the alluvial plateaux of Neuburg and Voxin are overgrown with sorrel, an index of the absence of lime.

Calvados. — The Bocage district: granite, sandstone, schists with proportion of lime 0.04 to 0.3 per cent.

Cacu Champaign. — Clays on Jurassic calcareous rock, 0.5 per cent.

Pays d'Auge: flinty clay and plateaux clays 0.4 per cent.

Manche. — The territory of the department includes 80 per cent of Archaic rocks, 10 per cent. of Trias and Lias, 2 % of Cretaceous formation and 5 % of recent alluvial deposits. The silts however cover the greater part of the primary rocks and contain 4 % of lime. The lime is only sufficient on the Lias and in the polders in the Bay of Mont St. Michel.

Orne. — I. Soils very poor in lime. Norman Bocage: granite traversing the Pre-Cambrian. Armorican sandstone, May sandstone, schists yielding flinty clays, or acid silico-argillaceous rocks.

Pays d'Houluce: Vire granite and mica schists.

II. Soils or strata poor in lime. — Flinty clay on Cenomanian chalk, Perche sands, Jurassic strata with lime washed out, blue clays of the Callovian formation, ancient alluvial soils and clays.

Region II: East.

Ardennes. — Primary formation, Devonian, Silurian: quartz sandstone, schists, slates, heaths and birch forests and pasture land, poor in lime: 35,000 ha. Turonian and Senonian chalk rich in lime: fertile cereal land: 100,000 ha.

Lying between the two: Jurassic strata, 25,000 ha. with a band of Albian Greensand, wooded sandstone, etc.

From the point of view of richness in lime considerable variety exists in this districts.

Marne. — Chalk is dominant except in the East (Porthois, Argonne), and in the West (Brie, Tardenois). The lime requirements are very small,

as the bare chalk covers two thirds of the department and a part of the remainder is wooded, but everywhere calcareous.

Aube. — Natural regions. Upper Jurassic 'Vignoble' containing up to 50 per cent. of calcareous material.

Lower Cretaceous, moist meadow land, calcareous soils, oyster-bed marls, coloured sands (140,000 ha.). The moist lands would profit by burning the lime of the calcareous soils.

Champenoise Chalk (280,000 ha.), forms the *Champagne pouilleuse*, which continues into the Marne: produces cereals and in particular brewing barleys.

Nogent Eocene, the different cultivated lands of la Brie, amount of lime adequate.

Flint-Clay of the Othe district, poor in calcareous material, can be marled with the substratum of chalk, if not wooded.

Valleys of the Aube and the Seine, alluvial gravels, poor for the most part in calcareous material.

Haute-Marne. — Completely occupied by secondary formations, chalk excepted.

Trias poor in calcareous material in its lower stratum, coloured sandstone. Rich in Muschelkalk of limited area, fairly rich in Keuper marls with 6 to 9 per cent. of chalk.

Lias. — Bassigny and oolitic strata rich in chalk, except for a few ferruginous beds. Light soils on the whole suitable for sainfoin.

Oxfordian Marls formerly cultivated in vines.

Corallion and Portlandian, dry, sometimes with the lime washed out, but poor.

Neocomian, fertile, calcareous, except at the base which yields marl.

Albion. — Greensands and clays, often wooded, always poor in lime.

Alluvial soils with adequate lime, as they come from Jurassic strata.

Haute-Saône. Primary formation occupies three cantons out of 38.

Trias without calcareous material or with lime washed out, except in the Keuper marls, occupies 7 cantons.

Lias extends over 7 cantons. The Lower Lias alone is deprived of lime.

Oolitic limestone occupies 9 cantons with lime content variable. The Tertiary is limited to 3 cantons where silica is dominant.

Moselles. — I. Northern Vosges, light siliceous soils, poor in lime; grows rye and potatoes.

II. Lorraine plateau. Triassic calcareous clay with lime kilns.

III. Liassic superstrata in limestone plateaux.

IV. On the left bank of the Moselle, the edge of the Woevre Jurassic formation is limestone.

V. The alluvial soils of the Sarre are siliceous. Those of the Nied, the Seille and the Moselle are friable soils, fairly rich in lime.

Meuse. — Department entirely Jurassic: the banks of the Meuse and the Barrois in particular are of limestone formation.

The Argonne and the region of the Woevre have in particular undergone loss of lime.

Meurthe et Moselle. — I. Vosges Mts., Vosges sandstone and variegated sandstone, not calcareous.

II. Lorraine Plains. Flinty alluvials of the Moselle and the Meurthe. Muschelkalk, Keuper marls and Lias with sufficient lime.

III. Oolitic plateaux with lime removed, and ferruginous.

IV. A quarter of the cultivable lands in the Department of Meurthe would benefit by liming.

Vosges. — The non-calcareous soils predominate.

La Montagne. Arrondissements de St. Die and Remiremont, i. e. 210,450 hectares; granite or Permian Sandstone.

Lime content always lower than 1 per cent., but much wooded, 41 per cent. forest.

Vôge: 102,993 hectares. Variegated sandstones, containing up to 0.6 and 0.8 % of lime. Very wooded: 29 % forest.

Alluvial soils of the Moselle: 6,000 hectares.

224,000 hectares in mountain and 73,000 hectares in the Vôge might be treated with lime as arable or grass land, but not more.

Bas-Rhin. The- Vosges are crystalline rocks with little lime. Keuper sandstones with varying lime content.

Plain of the Ill and the Rhine. Lias marls. Loess with 10 to 30 per cent. of lime. Gravel poor in lime.

Haut-Rhin. — Vosges crystalline rocks not calcareous.

Foot-hills of the Vosges often calcareous (Muschelkalk and Keuper).

Plain of the Ille and Rhine. — Diluvium or gravel. The arable land is less rich in lime than the sub-soil.

Sundgau. — Loess, the lime similarly removed from the surface, as also in the Jura.

Belfort. — Vosges granitic, igneous and schists without lime. Foot-hills of the Vosges: Permian sandstones and Vosges sandstone without lime.

Jurassic escarpment and Callovian. Oxfordian plateau Rauracian and Sequanian, calcareous.

Small Tertiary Tongrian (Oligocene), with lime removed from surface, marls to some depth.

Alluvial soils with no lime.

Region III: West.

A. *Brittany and Vendée.* — Region of primary strata, granite and gneiss and primary rocks, schists and sandstones.

Mayenne. — The geological outcrops of calcareous rock are staked out by the kilns and the lime made in these is sent all over Brittany for amendment. There is a strip of carboniferous limestone from the sur-

face of which the lime has disappeared so that it now contains less than five per thousand of carbonate of lime; next, the Jurassic strip. The 300,000 hectares which could profit by liming on an average application of 300 kg. per annum, or 90,000 tons, only receive 4,450 tons.

Three methods of applying the lime are in use: beds or large heaps near the field; small heaps covered with earth, which is the so-called English method; spreading the lime in the form of powder by means of a fertiliser distributor.

Marne et Loire. — The eastern part of this Department is of Tertiary formation of variable character. The western part, beginning from Angers, consists of schists with folds of carboniferous limestone, largely worked where crossed by the valley of the Loire. The lime kilns of Montjean in particular supply Loire Inférieure.

Ille et Vilaine. — This Department only contains two outcrops of Tertiary calcareous soil. Composts in "beds", piles of mould, ditch slime, dead leaves and lime are prepared, and from 3000 to 5000 kg. per ha. of these materials are spread every six years.

Côtes du Nord. — Only two calcareous beds. Sand is pumped from the bottom of the sea and sent inland as far as 100 km. from the coast.

Finistère. — The average content of lime on the arable land is only one per thousand, varying from 0.6 to 2.5 per 1000. It would be possible to use with advantage 400 to 500 kg. of lime per ha. per annum.

On the much indented coast use is made of sand containing shells, and tangue combined with wrack. As a result as well as on account of the total absence of frost in winter and the favourable effect of damp climate on early products, a belt of fertile soil (golden belt), worth as much as 50,000 francs per ha. is obtained.

The sands collected at low tide contain from 1 to 85 per cent. lime. From 4000 to 5000 kgs. per ha. are used every four years. The amount of lime imported from Mayenne is between 2000 and 2500 kgs. every four years.

Morbihan. — The strata only contain traces of lime. Between 300 and 500 kgs. would be needed on each of the 450,000 ha. under cultivation. Imported lime is applied to creps of potatoes and winter cabbages at irregular intervals and in amounts varying between 1000 and 1500 kgs. per ha. Calcareous sands are used on the Atlantic coast at Trinité, Belle-Ile, Ploemeur, Locmiquélic, Pouldu, which contain from 58 to 84 per cent. lime.

Loire Inférieure. — The amount of lime in the soil is only between 0.3 and 0.5 at most. It is quarried on the Carboniferous Limestone of Erbray and imported from Montjoan, generally as material of 90 per cent. purity (CaO). Out of the 570,000 ha. of soil, meadows and vineyards, barely 21,000 ha. are limed.

Vendée. — Vendée is formed chiefly of the "Bocage" of ancient rocks, bounded on the South by a fringe of Lias and bog. Three-fifths of the department have had to await the construction of roads in the XIXth century for the cultivation of wheat, clover and lucern to be

made possible by the use of lime and phosphates. At the same time the size and weight of animals increased.

B. *Poitou. Deux-Sèvres.* — The lines of lime kilns follow the calcareous layers of Jurassic or the North-West, South-East and South of the Department.

Liming ought to be extended over three quarters of the districts of Brossuire and Parthenay which constitute the prolongation of the "bocage" of Vendée or Gâtinais, and in addition over the Oxfordian marls of the South of Niort and Lozay which rest on a calcareous rock called Egrain or Chiffe, or Pierre Chauffante. The schistous marls of Rauratian or Sequanian should be marled in moderation rather than limed. The ferro-argillaceous red soils with flints of Poitou should be limed, as also the sands and green clays of the Cenomanian of Louzy, which should be marled from the Tertiary beds cropping out in the Valley of the Thouet and given 50 to 65 per cent, carbonate of lime; the variegated sands and clays of Upper Eocene; the terraced slopes of the plateaus of the Poitevin defile so far as they are not wooded: *moor* land similar to the landes covered with heath, ferns, gorse, broom, etc., the peaty valleys.

In the neighbourhood of St. Maixent and la Mothe Herave, a marl containing 70 to 90 per cent. carbonate of lime, is found at a depth of 50 to 70 cm.

Lime applications are made in inverse ratio to the proportion of humus, that is to say from 2 to 5 cubic metres every five years. Autumn liming is performed in small heaps of 15 or 20 kg., spring liming by distributing the large heaps of compost built up in autumn at the top of the fields and broken down during the winter. The ground lime of Airvault is now coming into use with fertiliser distributing machines.

Vienne. — Out of the 300 communes of the Department, 160 have soil poor in lime. The system of métayage on short leases does much to prevent the use of lime dressings which are especially necessary in the district of Montmorillon.

District IV: Central.

Central part of the basin of the Loire. South of the Parisian basin. Tertiary in the North; Jurassic in the South.

Allier. — The Miocene cropping out in the valleys are the only strata rich in lime. Their total area is 10,000 ha. out of 417,000 ha. of arable land. Either from 140 to 160 hl. of lime grit are scattered every 15 or 20 years or else from 35 to 40 hl. every five years. This process gives opportunity for the use of fertiliser distributors.

A. *Berry. Cher.* — The South of the Department comprises 35,500 ha. of granite, gneiss and Triassic sandstones. The North 140,000 ha. of clay with flints and Tertiary clayey sand of Sologne. Lying between the two, the Jurassic strata provides lime. Oyster beds cropping up in the valleys underneath the clay with flints provide marl. There is a tendency to use ground lime in order to save manual labour.

Indre. — The Tertiary clayey sands of Brenne and the granitic soil of Boischaud, with no lime, represent more than half of the Department and are separated by Jurassic chalk. Marling has been abandoned. Liming is still carried out at irregular intervals at the rate of 2 or 3 m^3 per ha.

B. *Touraine.* — Crossed by the Loire.

Indre et Loire. — Three-fifths of the Department are formed of sandy-clay soil. The plateaux are often covered by flinty clay (" Bournais " soil). The calcareous layer of Brie at one time provided marl. Shell marl or Tertiary shelly sand are chiefly found on the plateaux of Manthelan, Bossée, Louans, Savigné, Courcelles, St. Laurent.

Loir et Cher. — Four fifths of the Department, in particular the Tertiary clayey sand of Sologne in the South and the Secondary sands and clays of Perch in the North should be amended. On the calcareous layer of Beauce there is also " worn out " soil which the use of lime has restored to intensive cultivation. Lime grit for slaking is put in small heaps or else powdered lime is spread by the fertiliser distributor at the rate of 1200 to 1500 kgs. per ha., over land lying fallow prior to the growing of corn.

Marl or chalk are used at the rate of 25 to 60 m^3 per ha. About 20 lime kilns are to be found in the Department.

C. *Orléanais.* — Tertiary and Cretaceous strata predominate.

Loiret. — Beauce is calcareous. In the North Gâtinais consists of chalky slopes, covered with flinty clay and often wooded. Puisaye and Berry contain clay with flints covering the calcareous or ferruginous sands and clays of the Lower and Middle Cretaceous.

Orléanais properly so called consists chiefly of sands, covered with woods.

To the South of the Department is the edge of flinty clays of the Sologne to which enormous quantities of marl from Blancafort have been applied.

D: BOURGUIGNON-CHAMPENOIS BORDERS. *Yonne.* — The Department of Yonne forms the transition between the granite of Morvan and the chalky plateaux of poor champaign land, which are covered with flinty clay.

It is traversed obliquely by the sands and Albian ferruginous clays of the moist champaign land which are often covered with trees. These three zones are separated on one side by the strip of the Burgundian calcareous Jurassic and on the other by the Cenomanian, Turonian or Senonian marly clay. To the South, the Morvan which, moreover, is itself much wooded, uses the lime of the Lias, rich in phosphates.

In the North, the plateaux bordering on Gâtinais use chalk, often with phosphates, and reduced to powder. Marling has been given up. The amount of lime applied is at the rate of 30 to 40 hl. per ha. every 3 years.

V. DISTRICT: CENTRAL MASSIF OF FRANCE (Granite surrounded by Jurassic on the West and by Primary Triassic and Tertiary on the South).

Department of Loire. Granites, schists and mica-schists are deficient in lime. It is only found in appreciable quantity in the Tertiary strata of the Basins of Forez and Rannais (Valley of the Loire).

Department of Puy-de-Dôme. Three parts: (1) Granite substratum of Forez, Livradois and Combrailles, *i. e.* 500,000 ha. representing 5/8 of the surface of the department. (2) Volcanic Chain of Puys and Mont-Dore, 100,000 ha. (3) Valley of the Allier (Limagne), comprising another 50,000 ha. of soils poor in lime, in all 650,000 ha. of which 220,000 only are cultivated.

A suitable addition of lime is admitted to be 1200 kgs. per ha. per year, that is to say 270,000 tons; the tenth part only of this is in use nowadays. Lime is brought partly from the Department of the Allier, and costs about 100 francs per ton at the arrival station.

Department of Cantal. The Oligocene Chalks and marls have escaped erosion precisely where they meet the granite and the volcanic formation. Lime amendments are coming more and more into use in this district in contradistinction to the rest of France.

Department of Haute-Loire. Continuation of the Granite and the Volcanic formation of Auvergne. Soils containing more than 2 per cent lime are there an exception. The local chalk is only 75 per cent CaO, and is now not much used.

Department of Lot (Quercy). No liming is carried out either on the granites and schists which occupy 100,000 ha, or on the Lias (30,000 ha.) or on the rich alluvium of the Lot and the Dordogne.

Department of Aveyron. Aveyron comprises three districts: the granitic and schistous *Segala* (etymologically: rye soil), the "*rougier*"- red Permian soil, poor in lime, and lastly the *Causses*, chalk Jurassic plateaux often with the lime removed from the surface.

Out of a total of 437,000 ha. of cultivated land, 300,000 would profit by liming, at the rate of a minimum of 500 kilograms of lime per ha. and per year.

Liming is in fact effected at the rate of 15 to 20 hl. of lime every six years, on light soil. The amount is double on heavy soil. "Composts", or mixtures of vegetable debris and lime, are also prepared.

Department of Lozère. Includes both granite formations and the calcareous "causses". Owing to the altitude, the cultivation of this district is not intensive and transport of lime is laborious.

Department of Tarn. Comprises the East of the carboniferous strata which produces coal for the burning of lime. On the West are Tertiary soils.

Liming is accompanied by a good dressing of manure to prevent the "burning" of the ground and is carried out for clover, sainfoin, lucern, for cereals and for potatoes. The strata which respond most to lime are the primary schists, clay with Tertiary gravel and ancient alluvium, both fine-siliceous and "battantes", that is to say heaped up and known as "boulbènes".

Out of 200,000 ha. of cultivated land in Tarn, 100,000 would be benefited by liming.

Department of Nièvre. — The East of the Department is occupied by granitic Morvan (Cantons of Château Chinon, Montsauche, Luzy, Moulins-Engilbert), and schistous Morvan (Millay, Luzy). The siliceous strata contain little lime.

Bazois and the district of Clamecy are partly occupied by fertile chalk Lias, then by Middle and Upper Jurassic which is calcareous and dry, though sometimes the lime has been removed, leading on through the clays of the Lower Cretaceous and the sands or Middle Cretaceous to end in the clays and sands of the alluvial deposits of the Loire at Cosne.

To the South of the Morvan strata, the Lias is again to be found at St. Saulgé, St. Benin d'Azy and Décize.

To the South of Nevers, between Loire and Allier the strata is siliceous-clay.

Out of 260,000 ha. of arable land, 100,000 ha. would profit by amendments and out of 800,000 ha. of natural meadows, from 10 to 15,000 ha. Lime is used from the kilns established on the Jurassic strata.

Department of Creuse. — Lime has revolutionised the cultivation of this district which is given up especially to root forage crops. These crops occur in rotation every 4 or 5 years and take normally 1500 kg. of lime per hectare, that is to say 70,000 tons (on about 46,000 ha. of hoed crops) coming from the kilns built on Berrichon Lias at the edge of the Granite zone.

Haute Vienne. — Upper Limousin, a stock raising district like Creuse, employing 500 kgs. per ha. on arable land.

VI. District : East Central.

Department of Côte d'Or. — Almost entirely occupied by Jurassic plateaux and the Tertiary and Quaternary plain of Saône. There is no want of lime except in the so-called pasture lands of Anxois, the fine sands of the Valley of the Saône and the soils of Rouget du Châtillonnais.

Department of Saône and Loire. — The siliceous argillaceous breccia of Louhans, the granite slopes of Maçonnais, Autunois, Charollais, the schists and sandstones of Chagny, lastly certain decalcified zones of Jurassic, are all deficient in lime.

The lime burnt at Creuzot is used in September or May, in small heaps covered over with earth, to the amount of 1000 kgs. per ha.

Department of Ain. — The districts of Nantua and Gex are situated in the Jura or on calcareous glacial formations.

The plain of Bresse is formed of argillo-siliceous soil derived from Tertiary sand and non-calcareous yellow silts or loam. The Dombes is a moraine, poor in CaO. Much lime has been used there, but the kilns are now extinct.

Department of Rhône. — The Rhône soils are chiefly granitic, with only a small area of Jurassic strata. The lime residues of the Lyons manufactures are employed as sufficient amendment.

Department of Isère. — The strata of Tertiary, Glacial or Fluvio-glacial origin of the lower cultivated area, as well as the upper valleys of Oisans in the high granitic Alps, are usually deficient in lime.

Department of Doubs. — Although situated in the heart of the Jura the soil requires lime on account of the washing of the lime out of the upper layers.

Department of Savoy and Upper Savoy. — The mountain heights (Mont Blanc) are of granite or schist and little cultivated. They are flanked on the West by the calcareous Prealps.

The plateaux are sometimes decalcified to such a degree that sorrel replaces white clover on Glacial formations and even on Mollasse.

The cultivation of sainfoin (*Onobrychis*) is decreasing.

Basic slags give better results than superphosphate on the glacial plateaux near the lakes of Annecy and Geneva.

There are kilns at Pont du Gy, Vovray, St. Roch, Saint Jeoire le Giffre, but the lime is used chiefly for the electric synthesis of calcium carbide, by the employment of the power of the high waterfalls.

Department of Hautes-Alpes. — Most of the cultivated land is in a chalk district. The valleys are irrigated. Those of Briangonnais and ancient alluviums could alone be amended to advantage.

VII. District: South-West.

Department of Charente. — The granite and schistous formation of the district of Confolens and the Tertiary strata of the cantons of Champagne Mouton, Ruffee, St. Claud, Mansle, la Rochefoucauld, Montbron, Baignes and Brossac, are covered with vegetation: heath, gorse, broom, chestnut, timber. 130,000 ha. of arable land require lime.

Marl is found in the Lias and in the Cretaceous formation, but lime would be more suitable.

Produce-sharing tenants bear a third part of the expense of buying lime but undertake the transport from railway station to field.

Department of Charente-Inférieure. — The soil is deficient in lime and consists of Tertiary strata, marshy fields and lagoons; total 150,000 ha. requiring 4 cubic metres of lime per ha. There are lime kilns on the Jurassic strata of the two Sèvres and the Vendée.

Department of Gironde. — Eight-tenths of the soil are without lime: 400,000 ha. are Pliocene sand of the Landes, containing 82 per cent. silica, 10 per cent. clay and 8 per cent. humus.

The pine forest extends for 357,000 ha. and the Lande subsists where sandstone Ortstein is found near the surface.

Heavy, clayey, silico-clayey and silico-humiferous tertiary soil would also be benefited by lime.

Department of Landes. — The proportion of sand and of forests of sea pine is greater there than in Gironde. Marling and liming only affect the tertiary slopes of Chalosse and Armagnac which have various crops and soils; Marl — 10 to 20 cubic metres per ha. every 5 or 10 years; Lime — 1000 to 1500 kgs. per ha. every 3 to 5 years.

Department of Dordogne. — In the districts of Noutron and Ribérac, the produce sharing tenant pays for a third of the lime.

Department of Lot and Garonne. — In spite of the alternation of calcareous layers in the Eocene and Oligocene outcrops, lime is lacking in the alluviums of Garonne, Lot and Dropt, and of the plateaux, in the sands of

the Landes, in the soil of the valleys, that is to say over about half of the cultivated surfaces. Lime kilns, however, no longer yield rich lime.

Department of Gers. — Valleys separated by Tertiary plateaux covered over by Pyrennean siliceous strata: 45 per cent are deficient in lime. Much arable land is available, however, on account of the scanty population.

Department of Basses-Pyrénées. — Jurassic or Cretaceous strata covered over by Pyrennean diluvium or with the lime removed. The Miocene to the North of Gave du Pau is deficient in lime. Lime kilns at Montaut and Arudy, magnesian lime at Coarraz (Béarn) and Osses (pays basque).

Department of Hautes-Pyrénées. — Conditions similar to the preceding. It often happens that the content of the soil in lime is inferior to that of phosphoric acid.

Department of Haute-Garonne. Liming is carried on in the alluvium of the Garonne from Boussens to Toulouse and on the plateaux of Lauragais. The lime comes from Tarn or from Ariège.

Department of Tarn and Garonne. — One third of the total is deficient in lime. It includes the following: recent alluvium of Garonne and Aveyron (content in CaO lower by 5 %) ancient alluvium of Garonne and Tarn, among which is siliceous soil "battante" or "boulbine" while with quasi-colloidal silica and acid reaction; river gravels and plateau clay from Bruniquel to Montbauban; Molasse of Armagnac with the lime washed out.

Total 66,000 ha. out of 200,000 ha. of arable land of the Department.

Lime comes chiefly from Tarn, Bruniquel, Lexos and Suvillars.

Slaked lime is scattered in the fields in small quantities for lucerne.

Before growing cucumbers in an open field, ground chalk is applied. The amount is 1200 to 1500 kgs. of lime per ha.

Department of Ariège. — The plains cultivated over an area of 10 000 to 15 000 ha. between Mirepoix, Pamiers and Saverdun, as well as the Valley of the Salat, are covered by granite alluvium, and by Pyrennean schists and sandstones; they are therefore without lime.

PIERRE LARUE,
Gurgy sur Yonne.

Soil Biology.

The Bacterial Inoculation of Sugar Beet.

NEMEC, A. (Biochemical Institute for Plant Protection, Prague). Expériences sur l'inoculation de la betterave à sucre. *Annales de la science agronomique*, Year 41, No. 4, pp. 254-259. Paris, 1924.

Experiments have been carried on for some time past in the adaptation of the bacteria contained in the root nodules of leguminous plants to non-leguminous plants, and it has been noted that the success of the experiments largely depends upon the bacteria of the rhizosphere, or that part of the soil which is in immediate contact with the absorbent root hairs. These bacteria exert a favourable influence upon the penetration of the bacteria into the root hairs and hence upon the formation of the nodules.

The writer in his experiments used the B[illegible] method which is based on the principle of successive adaptations of the bacteria of leguminous plants to the juices of the roots of the plants which have been the object of experiment and of the heightening of their effect by means of repeated transmissions through the same plant. Experiments made on a large scale on this method have always given good results, the increase of the yield varying from 5.6 to 17 %. A negative result was shown only in cases where the yield of the non-inoculated control plots was at a maximum.

Hence bacterial inoculation provides a means of increasing the fertility of a soil up to the point of its maximum productivity. A. F

Insect and other Invertebrate Fauna of Arable Land at Rothamsted.

MORRIS, H. M. *Annals of Applied Biology*, 1922. IX, pp. 282-305.

A method of taking soil samples for determining the numbers of Insecta, Myriapoda, Oligochaeta, Acarina, etc. present in the first 9 inches of soil is described, and the functions of this inverterbrate fauna discussed. Soil was examined at definite intervals during a year and the numbers present at different depths compared on each of two plots receiving widely different manurial treatments. Of 15 millions of invertebrates per acre on the plot receiving 14 tons of dung per acre annually since 1850, 2.47 millions were insects. The greatest number of all kinds of invertebrates occurs in the first 3 inches of soil. The greater number of invertebrates found in the manured plot does not indicate a greater increase in the number of organisms directly harmful to the growing crop. The larvae of Elateridae, Tipulidae, and Hepialidae occurred in equal numbers in the two plots. It is suggested that the great difference observed between the numbers of insects found in arable land and those found in pasture (reported in a previous paper by the Author), and the greater depth of penetration, is due to the better aeration and drainage caused by cultivation.

P. H. H. GRAY.

The Physiology of *Thiobacillus thioxidans* an Autrophic Bacterium Oxidizing Sulphur under Acid Conditions.

STARKEY, R. L. *Jour. Bact.* Vol. 10, pp. 135-163, 1925.

Physiological investigations were carried out with one of the non filamentous true bacteria isolated from sulphur and soil phosphate composts by Waksman and Joffe. It oxidizes sulphur and thiosulphate rapidly to sulphate, even under extremely acid conditions. Oxidation was most rapid in the early stages of the process following a short lag period of about two days. The decreased rate of oxidation is not apparently due to any attenuation of the organism, or to the accumulation of toxic organic metabolic products, but rather to the accumulation of sulphuric acid. In the presence of high concentrations of thiosulphate (3 per cent) sulphur becomes precipitated in the medium during growth, probably indirectly and not as a product of the primary reaction of the process. With sodium thiosulphate as source of energy, 50 to 65 parts of sulphur as thiosulphate become

oxidized to sulphate per unit of carbon assimilated. In the presence of 1 or 5 per cent. sulphuric acid, the economy of utilization of the available energy was lower than in the absence of appreciable amounts of acid. The ratio of sulphur oxidized to carbon assimilated was not appreciably affected by concentration of potassium phosphate, as high as 5.5 per cent. Growth was but slightly effected by small amounts of salts of heavy metals, reduced pressure, or following substitutions of precipitated or amorphous sulphur for the rhombic form. The organism responded readily to changes in temperature, moisture, and partial pressure of oxygen or carbon dioxide.

AUTHOR.

The Carbon and Nitrogen Nutrition of *Thiobacillus thioxidans* an Autotrophic Bacterium Oxidizing Sulphur under Acid Conditions.

STARKEY, R. L. *Jour. Bact.*, Vol. 10, pp. 165-195, 1925.

A continuation of studies on the physiology of one of the true sulphur bacteria was concerned with the effects of some carbon and nitrogen compounds on sulphur oxidation. Dextrose disappears from the medium during growth and there is a general correlation between the amount of acid produced and dextrose removed. This disappearance of dextrose was not due alone to the acid, the suspended cells in a purely physical way, or to exo-enzymes, and the organism cannot use dextrose in the absence of sulphur or some inorganic sulphur compound as a source of energy. It appears that dextrose may enter into the metabolism of the cells in the presence of sulphur as a source of energy. Citric acid inhibited growth at 5.0 per cent. concentration but not in the presence of 2.5 per cent.

Ammonium nitrogen is the only source of the element that has been found available to the organism. The presence of nitrates in even as low concentration as 0.05 per cent. KNO_3 depressed oxidation and 1.25 per cent. completely inhibited oxidation. The economy of utilization of the energy available as measured by the carbon assimilated per unit of sulphur oxidized was much lower in the presence of nitrate than in its absence and the depression was greater in the presence of larger amounts of nitrate. It appears that the injury from nitrate is specific for the anion. Oxidation was inhibited in the presence of 2.5 per cent. of peptones and injury was marked at 1.25 per cent. Results indicate that neither urea, peptone, nor amino acids are available either as sources of nitrogen or carbon for the organism.

AUTHOR.

Seed Inoculation of Lucerne (*Medicago sativa*) and its Relation to Mobility of Nodule Organisms in Soil.

THORNTON, H. G. and GANGULEE, N. (Rothamsted Experimental Station). *Nature*, Vol. 114, No. 2878, pp. 932-933. London, 1924.

In their studies of the nodule organism (*Bacillus radicicola*), the method used by the authors consisted in making a suspension of a bacterial culture in a liquid, the suspension being used to wet the seed. There is evidence that after penetrating the root, the bacteria are unable to travel any

distance along it, hence, when the seed has germinated they must progress through the soil in order to reach various parts of the root system, where nodules are to be formed.

It was found that they will progress through light soil at the rate of about 1 inch in 24 hours. When a drop of water containing the bacteria in the rod stage is added to sterile soil, the organisms do not spread until after a considerable interval, which interval is less if the inoculum consists of a suspension in milk. This may explain the successful results obtained in Scandinavia where skim milk is used to make the suspension of bacteria employed for inoculating.

The authors tested the effect of inoculating sterile soil with a suspension of bacteria in skim milk containing 0.1 % $CaH_4(PO_4) \cdot 2H_2O$, and found that the spread of the organism from the point of inoculation began almost immediately. On averages of 10 parallel pots, increases in nodule numbers of 93 % and 73 % were obtained in two experiments by the addition of phosphate to the milk. There was also a favourable effect on the yield the crop. W. S. G.

The Importance of the Concentration of the Hydrogen-ions of the Soil in the Formation of Plant Substance.

CHODAT, F. Sur la concentration de ions du sol et son importance pour la constatation des formations végétales. *Bull. de la Société Botanique de Genève*, Series II, Vol. XVI, pp. 36 to 143, Geneva, 1924.

The author shows the importance of the concentration of the hydrogen-ions for the biochemical and biophysical processes and the physiological function of the critical state of the amphoteric colloidial substances, a state which has received the name of the isoelectric point.

A relation may be established between the phenomenon of the curves of growth as a function of the reaction of the environment; from investigations of this type it appears that the curves present two maxima and certain plants are proved to be entirely unsuited to soils with a definite reaction.

There is difficulty in classifying plants and plant associations into those requiring acids, those requiring neutral substances and those needing bases, until there is a clearer understanding of the corresponding reaction to the physiological neutrality, *i. e.*, to the iso-electric point of the plasmic tissues of the plant itself. It is thus convenient to substitute for the qualitative theories of "lime avoidance" and "lime requirements" that quantitative idea of range of accomodation to the reaction of the soil, in so far as the actual acidity of the soil has, in the greater number of cases, more influence on the distribution of the species of plants than the mineral components.

If, for example, we taken *Eupteris aquilina*, which has been always regarded as showing reaction to soils that are deprived of lime it is seen that it can also thrive under other conditions, within a range of PH from 5.5 to 7.6 and which therefore goes beyond neutrality. Contrary to current opinion, it is observed that marsh plant formations do not necessarily require an acid environment, although it is true that *Phrag-*

mitetum and *Scirpetum* belong to a group of formations which thrive in an alkaline environment.

The same values of P_H may however characterise soils carrying most varied plant associations: in this case the differences are determined by other factors, such as the geographical situation, the altitude, and climate. These formations differ among themselves in the strength of their vegetative growth and the specific type of their inflorescence and take the name of "homologues". Homology is displayed in a physiognomy special to these plant associations, a certain common element of floral type and a resemblance in the edaphic conditions.

This last characteristic makes it possible to classify the homologous formations into the acid type, passing from *Quercetum suberis* to *Ericeta varia*, *Calluneta*, to *Vaccinietum* and to the alpine tundra varieties, and the alkaline type which passes from *Quercetum ilicis* by degrees to the steppes on neutral and almost acid soil. To these two classes, the aquatic isomerous plants correspond: (A) wet moors, *Vaccinietum uliginosi*, *Sphagnetum*; (B) *Alnetum glutinosae*, *Eupatorietum*, *Caricetum*, *Phragmitetum*, *Scirpetum*.

The author then examines the genesis of *Sphagnetum*, which must be considered as a parasitic formation, taking root because favoured by the acidity of the forest and the moor land, and may find its way from either habitat and invade the *Caricetum*. This progressive movement may be traced and an examination made of the reaction of the pools of bog water and of peaty earth: and it is thus possible to observe a horizontal stratification of P_H. Gradually as one passes away from the forest on to acid soil, one passes from a maximum acidity corresponding to the *Sphagnum* zone to diminishing P_H values and to the *Caricetum* with a distinctly alkaline reaction. The waters of the two formations differ as does the P_H, at one metre apart the variation may be from 4 to 7.3. In certain localities (Lossy), the alteration in the course of a brook with an alkaline reaction has resulted in the disappearance of *Sphagnetum* and replacement by *Phragmitetum*.

On virgin soils of non-calcareous moraines, the plants first making their appearance bring about acidification, which is transferred to the successors.

The *Quercetum roboris* of the glacial soils of the Canton of Geneva shows an acid reaction of the soil, which explains the abundance of *Lathyrus montanus* and the patches of *Calluna vulgaris*, *Teucrium scorodonia*, *Genista germanica*, *Potentilla erecta*, which were at first considered as colonies from other localities. A. F.

Soil and Vegetation.

The Effect of a Varying Supply of Nutrients Upon the Character and Composition of the Maize Plant at Different Periods of Growth.

DULEY F. L. and MILLER, M. F. (1921) *Missouri Agr. Res. Bul.* 42.

Maize plants were grown in sand cultures with PFEFFER's nutrient solution of normal and N/20 concentrations. The growth period was di-

ided into three thirty day periods and all possible combinations of the two concentrations of solution were used. The second 30 day period was by far the most important for the production of dry weight. The top growth was always increased by an optimum supply of nutrients while a low supply of nutrients was conducive to increased root weight and to fibrous root development particulary during the last period. The ratio between the weight of roots and tops became wider as the crops grew older or as the concentration of the nutrient solution was increased. With low nutrient at the end of the first 30 day period the roots made up 61.18 per cent. of the total weight of the plant, but with plants having a high concentration of solution and 90 days old the roots made up only 12.29 per cent. of the total weight of the plant.

Where there was a copious supply of mineral elements present at the end of the second period, the leaves and stalks contained enough material to produce fair ears even where the third period had minimum nutrient. The per cent. of nitrogen and potassium in the plants was approximately proportional to the supply of nutrients during the period just previous to harvest.

In all treatments and in each period, a minimum supply of nutrients allowed a greater proportional storage of nitrogen, phosphorus, and potassium in the roots than did optimum treatment. A minimum nutrient supply changed somewhat the character of growth, particularly by reducing the length of the internodes. This was most marked where the plants had received optimum treatment during the first period.

Comparative Value of Alfalfa and Sweet Clover on Soils.

HOLTZ, H. F. and SINGLETON, H. P. *Journal of American Society of Agronomy*, Vol. XVII. No. 6, pp. 326-333. Geneva, N. Y. 1925.

The arid soils of the State of Washington contain sufficient mineral plant food elements, but are deficient in organic matter and nitrogen. When these soils are brought under irrigation alfalfa is generally grown to supply the nitrogen deficiency.

Soil samples were taken from fields which had grown alalfa and sweet clover respectively for three years in succession and other samples were taken from land that had grown these plants for three years followed by one year of maize. In addition, two other soils were selected, one virgin land never irrigated, the other an irrigated soil but which had never grown a leguminous crop.

In the experiment a comparative study was made of the carbon dioxide evolution and nitrate nitrogen accumulation.

Soil from sweet clover land had 102 % greater carbon dioxide evolution and 95 % greater nitrate nitrogen accumulation than soil from alfalfa land.

The yield of maize silage per acre was 14.92 tons on sweet clover land and 8.25 tons on alfalfa land.

Both virgin arid soil and the same soil after irrigation and cropping with non-legumes for two years, showed low carbon dioxide evolution

and nitrate nitrogen accumulation, owing to their low content in organic matter.

There is a greater carbon dioxide evolution during the first ten days and a greater final nitrate nitrogen accumulation from sweet clover than from alfalfa, whether they are grown in the field or applied as a residue.

For purposes of supplying available soil nitrogen to new land for establishing a short rotation, for seeding a pasture, or an orchard cover crop, sweet clover is especially suitable, because of its high nitrogen content and rapid decomposition when returned to the soil. W. S. G.

Regional Soil Science.

The Geology of Istria.

CUMIN, G. Appunti geologici sull'Istria montana. *Proceedings of the R. Accademia nazionale dei Lincei*, Vol. XXXIII, No. 5 pp 174-177. Rome, 1924.

Orographically it is possible to distinguish three mountain systems in Istria, viz. in the West the undulating high table lands, in the centre an area characterized by mountain ridges, in the East the chalky plateau of the Valsecca of the Castelnovano. The prevailing soils are for the most part calcareous, and there is a relatively small amount only of sandy soils, marls and schist clays.

The earliest formations are represented by the Cretaceous, always of the calcareous type. The oldest layer is Cenomanian sometimes combined with Turonian, which in this area is represented by grey calcareous breccia with a marl or dolomitic cementing, showing no fossils. This is covered by a blackish grey dolomitic mass. The dark Turonian chalks are in ridges varying from 0.80 to 1.50 metres in depth, over which lie strata of varying geological formation corresponding to the rubble rocks of Nabresina. There is no Cretaceous formation such as is typical of the Triestine Carso.

The base of the tertiary formation is represented by Liburnian, which in the lower strata is a lagoon, and in the upper a marine, sediment, consisting of black carbonaceous and dark-grey calcareous material. This merges without any definite dividing line into Lutetian, formed by light grey, white or more rarely blackish chalk, containing a numerous but not particularly varied fauna making it possible to distinguish different layers, which however do not exhibit any marked geological differences.

Above the calcareous system lies an intermediate formation, partly breccia, partly marl, over which lies the sandy marl layer of Bartonian Liburnian, a highly composite formation, consisting mainly of sandy marl and sandy flint schists with a calcareous cementing, and clay schists in variously alternating and shallow layers. Among these clastic rocks are found chalk ridges, particularly developed in Southern Istria.

The red soil belongs to the early quaternary period and partly to earlier periods; it lines the bottom of the Carsic and Doline pockets but is never found over extended surfaces. A. F.

Goethe and the Sicilian Red Earth.

FISCHER, Herm. (Munich). Goethe und die sizilianische Roterde. *Revue Internationale de Pédologie*, Nos. 3-6 1924.

In Lower Italy and Sicily red earth is not the prevailing type of soil; on the contrary, as a typically climatic soil it occurs only in an isolated manner and is only to be found to any extent near Palermo. Even there its occurrence is limited to the chalk and dolomite mountains. Red earth occurs as a secondary stratified deposit, i. e. in the plains. It is only formed above very fine, crystalline carbonate rocks. A higher proportion of clay in the rock seems to prevent its formation. The red colouring iron compound may be due to the original content of the non-decomposed rocks in iron sulphide and iron carbonate. The approximate extent of red earth round Palermo has been illustrated by a sketch map, in the article. It follows that, owing to the nature of the rocks (Noric dolomite) and the climatic conditions (high summer temperatures with sufficient precipitation) the coastal district of Cefalu near Trapani is favourable to the formation of red earth. In the interior of the country red earth is seldom to be found, and it is confined to the southern side of the mountains.

As early as 1787 GOETHE, on his journey to Sicily, followed the line of occurrence of red earth near Palermo. Red earth in primary stratification is found: (1) at Mount Pellegrino, (2) at San Martino, and (3) behind Monreale. The zone of outcrop of dolomite was also observed by GOETHE. Starting from beneath Monreale, the author has submitted to chemical analysis the non-decomposed dolomite, the zone of white, friable, deposit and the red earth lying above it, and has found that, in decomposing, dolomite loses a greater percentage of magnesium than lime. The sesquioxides increase fifty-five times more in red earth, as compared with their proportion in dolomite. On the heights of the mountains surrounding Palermo red earth is not formed, but a deposit occurs, which is poor in humus, and externally somewhat resembles brown earth.

THE AUTHOR.

The Soils of Moistad Experiment Station, Hedmark, Norway.

GLOMME H. Meldinger fra Norges Landbrukshoiskole. No. 1, 1925, pp. 33-92, bibliography, 1 map. Oslo, 1925.

The article gives a detailed description of the soils occurring at Moistad Experiment Station, Hedmark; similar investigations are to be made at the Norwegian Station.

The investigations have been carried out by means of borings made to a depth of 1 metre, the character of the soil being examined at different horizons. Samples are submitted to mechanical analysis, determination of water capacity, volume weight, specific gravity, pore space, chemical analysis and determination of H-ion concentration and lime effect.

The bed rock is formed of Ordovician limestone and slates, and the soils consist, from a geological point of view, of moraine residues and peat and similar organic soils.

W. S. G.

Soils of Pays de Gex.

GRAVIGNE, GILLET and DENIZET. Etude scientifique des terrains, des fourrages et des laits du Pays de Gex. *Congress on Alpine Pasture at Gex*, pp. 35. Dijon, 1924.

Pays de Gex consists of an arrondissement of the Department of Ain on the Swiss frontier. It is a mountain range stretching from South-East to North-West over an extent of forty kilometres and rising to from 1300 to 1600 metres in height.

It is formed of the Middle Jurassic strata, viz., Astartian, Sauracian, and upper (Portland) limestone, flanked by Lower Cretaceous rocks (Urgonian) or marls (Valangian).

On the West lies the valley of the Valserine, a tributary of the Rhone. On the East is the plain of Geneva, which is relatively a plain, and of glacial formation with alpine erratics and Molasse outcrops rising to a height above 600 metres.

Going from East to West however, it has been possible to distinguish the following bands or zones: Alpine erratics zone with variable lime content. Soil called " battante ", having fine sandy constituents piled up under the action of rain, and without any nitrogenous matter.

Glacial Zone with outcrops of Molasse, clayey, content variable as to limestone, scarcely " battante. "

Intermediary Zone between the plain and the mountain, the same strata dominated by the Lower Cretaceous at the foot of which the towns are built.

On the slopes, the soils are tenacious and argilo-calcareous . In the South they are less clayey and not calcareous. Zone of the Valserine clay soils rich in nitrogen and phosphoric acid, prevail.

On the plateaus are friable soils.

If the proportion of grasses G., leguminous plants L. and sundry plants D., be reduced to 10, the following result is obtained for the plain *meadows* (height 500 to 700 m.).

5 to 6.5 G + 1 to 3 L + 2 to 3 D.

On the unwatered slopes, from about 700 to 900 m., are found: 1 or 2 G + 3 L + 5 or 6 D ; in other words, the proportion of grasses decreases.

On alpine pastures at a height between 130-150 metres there is a still greater increase in the proportion of diverse plants of which a large number are decorative (Orchids) or medicinal (Gentian, Thyme, Veronica).

The richest milks come from the most fertile zone at the foot of the mountains (Lower Cretaceous), where the fat content is 41 grams instead of the average 39 in the plain and 38 ½ in the Valserine.

PIERRE LARUE,
Gurgy sur Yonne.

Beetroot Soils in Bohemia.

JANOTA. R. Sur les sols betteraviers en Bohême. *Publication of the Ministry of Agriculture*, pp. 79. Prague, 1923.

The cultivation of beetroot in Bohemia is carried on mainly in a district where the soil is more favourable than the climate to its growth. The amount of rainfall is a limiting factor for the development of this crop, and hence there is an intimate connection between rainfall and yield.

Beetroot soils are: calcareous and non-calcareous loess, alluvial and Permian clays and lastly the sandy clay of the carboniferous stratum. The physical properties, and above all, the air and water capacity of these soils make them well suited to beetroot. The author has studied the variations of the physical condition of the soil profile under all its aspects, and draws the conclusion that beetroot requires deep tillage to ensure a sufficient quantity of water. Czech beetroot soils have the following content in nutritive matter (in 10 % HCl).

P_2O_5	0.1 %
CaO	0.5 to 1.5 %
K_2O	0.25 to 0.3 %
N (total)	0.15 to 0.3 %
Humus	0. to 4.0 %

SMOLÌK.

Soils of Overflow Meadows on the Banks of the Volxhov and Lake Ilmen.

PRASSOLOV, L. Untersuchungen des Flusses Wolchow und dessen Bassins, Bul. IV, pp. 5-24, with 7 maps. Leningrad, 1925.

The overflows of the Volxhov and Lake Ilmen have a total extent of over 1500 square km. The chief meadow areas are the deltas of the Lovat and the Usta on Lake Ilmen as well as the great flood plain of the Volxhov at the Grusino. In the flood plain of Lake Ilmen alluvial sub-clayey and sub-sandy stratified soils prevail. However, the greater part is occupied either by swampy meadows of low level, or by peat bogs. High overflows also include large forest areas. In the valley of the Volxhov, clayey, alluvial soils are found, sometimes covering the whole area. In the riverside part of the plain unstratified, alluvial meadowy soils of granular texture. Their area is however not large. The low level areas are most general, either with clayey swampy soils, or peat-bogs. In the region of Grusino, elevations of two kinds are encountered; some of them are no more than 1-2 m. in height and are narrow and elongated, the so called "weretye" (roller) with clayey alluvial, but clearly podzol soils. Others are higher, not overflowed by high water (25-35 m. above sea level), consisting of glacial deposits. Sandy undulations and hillocks may also be seen either along the tributaries of the Volxhov, or on the banks of ancient lakes. A considerable part of the flood plain of the Volxhov, marshy

on its left side, is covered with forest. Soils here are swampy podzol. Similar soils are encountered under a stratum of new alluvium and in the meadow part of the valley, together with "buried" peat-bogs.

To estimate the effect upon the soils of the valley of the Volxhov, produced by the rise of its waters due to the dam under construction, continuous observations were undertaken in 1924 on the level of the soil water and the humidity of the soil (together with observations on vegetation).

The soil of the flood plain of the Volxhov and the lake Ilmen are in their present natural state of different value grading from best soils of highest value (such as riverside granular soils) to those of low value and useless marshes. In respect of area, the soils of middle and low quality prevail, many of them however, might be improved and have perhaps, a great "potential" value. AUTHOR.

Geology of the Sarthe.

WELSCH, JULES. Esquisse géologique des régions naturelles du Departement de la Sarthe, pp. 30, I map in colour, scale I 320.000. Le Mans, 1924.

The primary stratum forming the Western part of the Armorican massif is frequently vertically inclined and is crossed by Granites, Porphyries, Amphilolites, Diorites, Diabases and Petrosilex which only play a secondary part in agriculture.

The schists give a deep siliceous soil often covered with heath. The Silurian magnesian limestone is valuable.

Sandstone intercalations (Armorican sandstone) occur in the middle of the schists, covered with heaths and pine forests.

The Devonian and the Carboniferous layer yield lime for agriculture. The kilns from which lime was exported to Brittany are still to be seen along the face of these strata.

Secondary strata are represented by Jurassic and Cretaceous formations.

Jurassic. — Marl Lias only appears to a certain extent in the North.

Middle Jurassic (Bajocian, Bathonian, Collovian, Oxfordian) form the *Champagne du Maine.*

The term "Champagne" or "Campagne" is used in France to designate the calcareous treeless plains belonging to Middle or Upper Jurassic and to Upper Chalk.

In the Sarthe and the West of France, the arable land, which is pebbly and from which the lime is washed only to a shallow depth, is called "groie". It is red and argillo-calcareous. These are districts with dry, cereal-producing valleys. Certain strata of Bathonian contain flints.

The more marly Oxfordian is the formation of Saosnois and Belinois which are surrounded by heaths and pines of the Forest of Persegne on one hand, by ferruginous Cenomanian sands on the other, and by the valley of the Huisne which meets the Sarthe at Le Mans. These tenacious marly soils are well suited for artificial meadows and cereals.

The Cretaceous rocks begin by Cenomanian, which took its name from

Le Mans (Cenomanum) and is generally silico-ferruginous with glauconite: Perche sands with reddish coloured sandstone soils suitable for rye and potatoes occur in woods of Scotch or Baltic pine.

Marly chalk beginning in the Cenomanian layer continues in the Turonian and the Senonian in the South-east of the Department. It forms the sides of the valleys which are lined with clay containing flints washed out of the chalk: it is also the tufa of Anjou, sometimes containing flint nodules or shale and provided the marl for applying to the soils of the siliceous plateaus. Content in calcium carbonate: 50 to 95 %.

Cretaceous layers cover 200 000 hectares of varied aspect out of the 624 000 hectares of the Department of the Sarthe. Clay with flints covers 80,000 hectars.

Clay can be brought up again to the surface, which makes it more easily worked and there is a scarcely perceptible transition to the clay of the somewhat calcareous argilo-sandy plateaus of Pliocene origin.

Ancient alluviums cover from 50 000 to 60 000 hectares. They are generally siliceous, with the exception of those of the Saosnois Orne which cross the Jurassic calcareous strata. They are for the most part dry and bear pine and oak.

Recent alluviums (50 000 hectares) are richer and moister: meadows, vegetables, poplar trees.

PIERRE LARUE,
Gurgy sur Yonne.

The Agricultural Regions of North Dakota.

WILLARD, Rex E. *Bulletin 183 North Dakota Agricultural Experiment Station*, pp. 168, figs. 64, tables 20. 1924.

The Bulletin gives the location and description of the Black Earth Belt (Eastern), the Farming Grazing Belt (Central) and the Grazing Forage Crop Belt (Western), the climate, soils, land utilization, and general trend of both yield and acreage per farm. The area, size of farm, climate, soils, crop areas, crop yields, crop damage, extent of live stock per farm, position as regards production of the State and the agricultural districts of each county are stated. Yields of wheat, oats, barley, rye, flax, corn, potatoes, and hay are given for 1911 to 1922, inclusive.

T. CHAPMAN.

The Principal Results and Fundamental Problems of Soil Investigation in Georgia.

ZACHAROV, S. A. *Annals of the State Polytechnic Institute, Tiflis*, Vol. 1, pp. 1-56. 1924.

The soils of Georgia (formerly Tiflis and Kutais departements) have not as yet been subject to systematic investigations. Short descriptions exist and sketch maps of the low part of Western Georgia and [illegible] only, but investigations of Eastern Georgia, and mountain districts are scarce and occasional. This short essay is to be considered as an attempt

to make use of scattered information about the soils of Georgia to summarise them and give a temporary classification of the soils, divide the country into areas, and point out the essential theoretical and practical problems that the soil investigations in this country have to resolve.

The soil of Georgia varies greatly in accordance with the combinations of the soil forming agencies, among which the relief is of prevailing importance: it influences the soil directly, and also indirectly, and is reflected in climate and vegetation.

The predominant types of soil formations in Georgia are:

1. Laterite soils;
2. Podzol soils (white ash-coloured and very much leached);
3. Forest soils;
4. Maroon brown soils (soils of herbaceous steppes, maroon brown colour);
5. Brown soils (soils of worm wood — herbaceous steppes);
6. Mountain meadow soils (alpine meadows — "Eylags").

Besides the completely developed, or normal soils, incompletely developed soils are largely found in Georgia. Their formation has been disturbed by geological processes: denudation, "diluvium" and "proluvium", resulting in the formation of rough, skeleton (stony) soils, in which the local soil-forming process is not fully expressed.

According to distribution of soils Georgia may be divided into areas as follows:

I. Soil area of Western Georgia (Kolchida).

1. Marsh-podzol zone of Kolchida lowland, below 1000 feet, with rainf all of 1200-1700 mm. Alder forest with lianas.

2. Laterite-podzol zone of lower mountains of Kolchida, 50-3000 feet elevation, with rainfall of 2400-1200 mm. Forest with lianas.

3. Zone of forest soils of Western Georgia-middle, mountains 2000-6000 feet elevation, with rainfall about 1200 mm. Oak, beech and fir forests.

II. Soil region of Eastern Georgia (Kartli and Kakheti).

4. The zone of tchernozem and maroon coloured soils occupies the lowest and dryest parts of valleys, lower mountains and plateaux below 3000 feet, with rainfall, about 600 mm.; covered with halophytes — worm wood — herbaceous and mixed herbaceous steppes.

5. The zone of forest soils occupies a part of the valleys and central mountains of 2000 to 7000 feet elevations, rainfall 500-800 mm. Elm, oak, beech, pine and mixed forests.

III. The mountain zone — tchernozem occupies the plateau of Little Caucasus, 5000-7000 feet; with rainfall of 500-600 mm.; meadowy mountain steppes with Stipa.

7. Zone of mountain soils of the ridges and summits of the Little Caucasus with Festuca-steppes.

IV. The high Mountain soils, region of Georgia occupie the areas above 6000-7000 feet to the snow-line. It is characterized by a local climate and local soils. It can be divided in following districts:

8. Zone of high mountain soils of the Great Caucasus, with rain-

fall of 1200 mm., with alpine and richest sub-alpine tall herbaceous meadows (swaneti).

9. Zone of high mountain soils of the Adzhjaro-Jmereti and Trialety chain with rainfall of more than 800 mm. and with alpine and sub-alpine meadows.

Among the theoretical problems, which are to be resolved next, we mention the following:

(*a*) The vertical distribution of soils;

(*b*) The origin of laterites and of their residual character;

(*c*) The origin and the conditions of brown forest soils, original soils of Georgia;

(*d*) The geography and topography of mountain meadow soils;

(*e*) The history of the soil mantle on Georgia in connection with the presence of degraded, buried and fossil soils.

Practical problems of study of soils are the following:

(*aa*) The study of carboniferous soils of vineyards and the nature of carbonates, in order to extend the use of American *Phylloxera* resistant stocks;

(*bb*) Manuring and tillage of laterite soils;

(*cc*) Manuring and tillage of podzol soils;

(*dd*) The study of mountain meadow soils in order to use them in the most scientific way;

(*ee*) A detailed division of the country into soil regions;

(*ff*) Soil testing.

The new Faculty of Agriculture, represented by professors and students — future agriculturists — is willing to do its utmost with respect to the study of soils in Georgia.

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Communications.

International Society of Soil Science. — The number of members is now 592, of whom only about 400 have paid their subscriptions and entrance fees for 1925. This made it necessary to send out a reminder to nearly 200 members, involving considerable time and expense.

I should like to take this opportunity of once more pressing on my colleagues the desirability of forming national sections, which could take over a part of my work, for example: the sending of notices, etc. to new members, the collection of subscriptions, recording of change of address, etc. A proportion of the annual subscription of 6.50 francs, either 0.50 or 0.75 fr. could be placed at the disposal of the national sections for the purpose of covering expenditure.

As you will be aware, on Circular 4 of May 1925 I requested the members to inform me whether they wished to receive the Proceedings of the International Soil Science Conference in Rome (May 1924) at the reduced price of 80 francs, the price for the general public being 150 francs. A number of members have misunderstood the circular and have sent me the 80 francs. I have therefore to ask them to note that the matter is in the hands of the International Institute of Agriculture (Villa Umberto I. Rome [10], Italy) and that I have forwarded all money sent to this address. Members who have made enquiries as to the date of publication of these proceedings are also referred to this address.

Members are again requested to remit the annual subscription in Dutch guilders, either by post office money order or to the Geldersche Crediet Vereeniging, Groningen (Holland), paid to the account of the International Society of Soil Science. In either case it is essential to add my name.

By arrangement with the editor, Prof. SCHUCHT, the list of members will appear in the first part of the new year 1926. Members are therefore requested to be so good as to send me word of any change of address in good time.

Dr. D. J. HISSINK,
Acting President and General Secretary.
Herman Colleniusstraat 25, Groningen (Holland).

Brief statement concerning progress made in the organisation of the First International Congress on Soil Science. — (1) The personnel of the Organising Committee has been completed. It consists of: F. J. ALWAY (University of Minnesota, St. Paul), F. E. BEAR (Ohio State University, Columbus), G. S. FRAPS (Agricultural and Mechanical College, College Station, Texas), R. HARCOURT (Ontario Agricultural College, Guelph, Ontario), S. B. HASKELL (Massachusetts Agricultural College, Amherst), D. R. HOAGLAND, (University of California, Berkeley), T. L. LYON (Cornell University, Ithaca, New York), C. F. MARBUT (U. S. Department of Agriculture, Washington, D. C.), A. G. MCCALL (University of Maryland, College Park), W. H. MCINTIRE (University of Tennessee, Knoxville), M. F. MILLER (University of Missouri Columbia), F. T. SHUTT (Dominion Experimental Farm,

Ottawa, Canada), F. A. WYATT (College of Agriculture, Edmonton, Alberta), J. G. LIPMAN (Director, Experiment Station, New Brunswick, N. J.).

The personnel of the Exhibits Committee has also been completed. It consists of: E. TRUOG, (Chairman, University of Wisconsin, Madison), C. H. SPURWAY (Michigan Agricultural College, East Lansing), S. D. CONNER (Experiment Station, Lafayette, Indiana), R. M. SALTER (Ohio State University, Columbus), H. J. HARPER (Iowa State College, Ames), F. W. PARKER (Experiment Station, Auburn, Alabama), W. W. WEIR, (U. S. Department of Agriculture, Washington, D. C.).

(2) The Secretary of Agriculture, Mr. JARDINE, has promised to see that a resolution is introduced after Congress convenes in December. This resolution will authorize the President to invite foreign governments to send delegates to the Congress.

(3) The itinerary of the field excursion, which is to follow the meetings in Washington, has been prepared by Dr. MARBUT. Arrangements will be made to dig pits at certain locations in the United States, and possibly also in Canada, in order that the soil profiles may be clearly shown to members of the Congress.

(4) Funds are being collected for financing the field excursion. It is hoped that enough money will be available so that the field excursion, which will last about four to five weeks and which will carry the party from the Atlantic to the Pacific shore, will be without cost to the foreign delegates. Very substantial contributions toward the expense of the field excursion have already been promised.

(5) It is expected that by next November, when a formal meeting of the Organizing Committee will be held in Chicago the necessary funds for financing the field excursion will have been subscribed. At that time final arrangements will be planned for the program and for the appointment of such other committees as will be necessary to insure the success of the meetings in Washington, etc.

(6) The National Research Council, The Association of Land Grant Colleges and the American Society of Agronomy have also pledged their co-operation. The American Association for the Advancement of Science and the National Fertilizer Association will also offer such co-operation as they may be able to give us.

(7) Additions to the membership of the International Society of Soil Science are constantly being made. It is expected that by next fall there may be possibly as many as two hundred members in the United States.

J. G. LIPMAN.

Etat de l'étude et de la cartographie du sol dans les divers pays. — This volume, published under the direction of the late Professor MURGOCI is now printed in full, with the exception of three colour maps which cannot appear therefore this winter. Since the last International Soil Science Conference, Professor MURGOCI added many photographic illustrations and plates to this volume.

Those who, previous to the last International Conference, received the incomplete volume, may apply for the work in its final form to Prof. PROTO-

PESCU-PAKE, Institutul Geologic al Romaniei, Sectiunei Agrogeologice, Soseana Ardealului (Kiselef) No. 2. Bucharest, Rumania.

Appeal for Cooperation in the Work of the Sixth Commission on the Application of Soil Science to Scientific Agriculture. — The utilization of the soil of the national territory so as to cover most completely the subsistence requirements of a country, proved during the war in every country to be one of the most important tasks of the public economy. In consequence, close attention was given during the war by all circles and even more has been since given to the improvement of the soil with a view to intensification of the production of necessaries. There has been accordingly a development beyond all anticipation in the technique of cultivation, directed towards such treatment of the soil as will ensure a better agricultural utilisation. In close connection with this the need is felt for depending this branch of technique on scientific lines, which would also have the effect of rendering the relations between the soil and the means for its improvement, the subject of practicable scientific research.

The Third International Soil Science Conference, held in Prague in 1922, recognised the interrelation between these facts and took them into account so far as to appoint a sub-committee of the Commission for the Study of Soil Physics and Mechanics, which should make a special study of the application of soil science to scientific agriculture. This sub-committee took upon itself for the Fourth International Conference in Rome in the year 1924 a task of some magnitude which consisted in the application to scientific agricultural schemes of mechanical analysis of soils by decantation.

The Commission drew up a number of conclusions on the basis of proposals and discussions, and among these the following may be specially mentioned :

A. The Organisation of Soil Science Service.

(1) A complete and scientifically sound knowledge of soils is the essential basis for an effective and economical solution of all amelioration problems. Hence all measures for soil and land improvement should be based on absolutely reliable soil and hydrological investigations.

(2) It is essential that provision be made for the organization of facilities for soil investigations in their relation to land cultivation. It is recommended to the respective governments that, where this has not already been done, suitable committees be appointed to serve in an advisory capacity as regards the organization of a soil science service. An effective organization of this sort has been created in Czechoslovakia.

(3) Research on land reclamation and water supply problems is urgently needed for the development of land cultivation methods.

(4) It is necessary that the college curriculum in agricultural engineering should be based on the natural sciences with special reference to soil slence.

(5) In order to avail ourselves promptly of the definite results from the accumulated comparative experiments in the various countries under the most variable conditions, it is important that all societies, institutions, bu-

reaus and other bodies interested in soil science should become affiliated with the "Committee on the application of soil science to scientific agriculture" of the "International Society of Soil Science."

(6) This International Committee met for the first time in Rome in May 1924. The working programme accepted for the soil science service in Czechoslovakia and also the plans proposed for Germany were submitted. These projects may be considered as the basis for a programme of soil science service in each country.

B. The Programme for the future work of the Committee.

(7) As topics for consideration at the next conference the following should be studied:

(a) Working methods of the Soil Science Service.

(b) Organization of experiments on methods of soil improvement.

(c) Data on the influence of the improvement of various soil types.

(d) Results of the experiments in land cultivation in reference to the "drainage theory" (depth and distance). In order to obtain comparative results it is desirable that the Committee members should receive from the various countries descriptions of the established drainage experiments of characteristic soil profiles.

The next meeting of the Commission, which will take place in Washington on the occasion of the First International Soil Science Congress in 1927, will be devoted to these and other important questions of soil science and scientific agriculture and will attempt their solution on an international basis.

It is obvious that there will be a fuller realisation of the end in view in proportion as experts both on the scientific and the practical side become members of the Commission and in proportion as more countries are represented on it. The more varied the scope of the work of the Commission, the greater value will attach to the results of its investigations.

The Commission therefore makes an appeal to all experts, who are engaged in scientific agriculture either on the purely scientific or on the practical side to join the Commission and to take an active part in its work and the State authorities who administer the service of scientific agriculture are invited to appoint representatives on the Commission.

It is our firm conviction that our work will be of great value to all countries and we are of opinion that for this reason we may count on some consideration of this invitation to join the International Society of Soil Science and in particular to join this Commission.

Groningen and Zurich, 25 September 1925.

For the International Society of Soil Science: The Acting President and General Secretary,

DR. D. J. HISSINK,
Herman Colleniusstraat 25, Groningen.

For the Sixth Commission for the Application of Soil Science to Agricultural Science:
Chairman of the Commission

J. GIRSBERGER, *Ing. Agr.*
Zurich.

The conditions for admission to the International Society of Soil Science are as follows :— Any individual or body corporate engaged in the study of soil science, is eligible for ordinary membership.

Members of the Society are entitled to receive the Review post free on payment of the annual subscription.

The subscription for 1925 is 6.50 Dutch guilders, with an entrance fee for new members of 2.50 guilders.

Proposals for membership must be sent to the Acting President and General Secretary of the International Society of Soil Science, Dr. D. J. HISSINK, Herman Colleniusstraat 25, Groningen (Holland), or to the Chairman of the Sixth Commission for the Application of Soil Science to Scientific Agriculture, J. GIRSBERGER, Ing. Agr., Zurich, Switzerland.

Proceedings for 1926. — We kindly ask the readers of our paper to be patient with us if the various issues do not appear as punctually as is desirable There are many technical difficulties to overcome, but these seem to be eliminated now after a conference of the undersigned editor with Dr. G. A. R. BORGHESANI, which took place in August 1925 in Rome. For technical reasons the size of the present number 4 had to be cut down somewhat, but from January 1926 on the paper will again be edited with increased contents and, above all, will appear punctually.

P. SCHUCHT,
Editor.

PROCEEDINGS OF THE INTERNATIONAL SEED TESTING ASSOCIATION

Papers.

CONTRIBUTION TO A MONOGRAPH ON THE DETERMINATION OF THE COUNTRY OF ORIGIN OF CLOVER AND FORAGE CROP SEED.

When it was realised, that, according to their country of origin, seeds may be grown in quite different conditions, the determination of the country of origin became one of the most important tasks of seed laboratories. It is known that incidental seeds are removed from the samples to be examined and on the basis of their geographical extent, the country of origin of the seeds is determined. Many works have already been published on the subject, but they often follow no definite method and are sometimes incomplete and do not give a full tabulation of incidental seeds in samples from different countries.

Consequently, in the third International Conference on Seed Testing, Dr. A. VOLKART pointed out, in a report on determining the country of origin, the necessity of taking notice not only of the weed seeds removed for the above mentioned purpose and which so far served as guides, but also of every other incidental seed occurring in a sample, as well as of other signs. Dr. VOLKART was then charged by the Congress to make proposals for a method of research for determining the country of origin of clover and forage crop seed, a standard method capable of answering every requirement. The proposals were forwarded to the representatives of the various countries taking part in the Congress. In consequence of this, the directors of the State seed laboratories of each country must examine, according to definite instructions, a quantity of seed samples of their own country, with a view to the detection of foreign seeds, to weight per thousand seeds and to colour, determining at the same time, the incidental seeds according to species and number. In the fourth International Conference for Seed Testing held at Cambridge in 1924, Dr. VOLKART was already enabled to describe many researches conducted after the method he suggested and which had brought to

light valuable and so far unknown facts. Unfortunately Dr. VOLKART is no longer able to continue directing the work. Therefore, in the fourth Conference, at Cambridge a Commission was appointed, with the help of which the task is to be continued by myself. Having agreed with the Director Dr. VOLKART, on the beginning of March, and having taken the advice of the members of the Commission, the most convenient arrangement seems to follow the excellent plan proposed by Dr. VOLKART, making works known under the above mentioned title.

In the compilation of the results obtained a distinction was made on the one side according to the frequency of occurrence of the additional seeds in all the samples (constancy), on the other side according to the number in each sample (dominance). The following summary of each test of the country of origin show the frequency of occurrence (constancy) by reporting the number of the samples in which each species is found, shown in four sub-divisions:

Very frequent	additional kinds	in 75.1-100 %	of the samples tested
Frequent	"	in 50.1- 75 %	"
Less frequent	"	in 25.1- 50 %	"
Isolated	"	in 0.1- 25 %	"

The dominancy is shown by the highest number found in 1000 gm. and by the average for each sample in which it is generally found.

According to the difference of country of origin of clover even the colour shows sundry differences determined by means of the relative quantity of yellow and violet grains. In consequence of this, it has been suggested to divide a determined number of grains into five different parts of " violet, prevailing violet, mixed, prevailing yellow and yellow " and to ascertain the percentage.

Samples to be examined must be submitted from quite trustworthy sources only and after various crops. Besides, different kinds of red clover, as, for instance, early and late clover, must be separately treated as explained with full particulars by A. VOLKART in the publication issued as a report on the Fourth Conference of the International Seed Testing Association, held at Cambridge (1). The researches on red clover respecting country of origin are therein assembled in similar lists and provided with an additional text by

(1) Published by His Majesty's Stationery Office, London, 1925.

Director K. DORPH-PETERSEN for Denmark, by Director A. W. FRANCK for Holland, by Director JOHN ENESCU for Roumania and by GUSTAV WIKSELL for Stockholms Län.

The following researches show the continuation of the work begun by A. VOLKART, retaining as far as possible his method of recording. A difficulty arose in publishing the lists with only one nomenclature. Following VOLKART's proposal, the different species should be named only according to the decisions of the International Botanical Congress at Vienna. In consequence of the different interpretations that our classifiers give to the idea of varieties and species and in consequence of the variable mode of writing, I followed chiefly modern and important botanical works and the *Index Kewensis*, placing meanwhile, in brackets, the different name used by the sender.

The text attached to each list can of course be founded only on the weed seeds studied therein and has therefore only a relative value. Only after the issue of a work, as far as possible complete, provided with numerous data respecting samples, and treating of all the countries of origin so far considered, will it be possible to give a connected table of the whole question. On the other hand, the results obtained up to the present time show a great increase of knowledge on the seed content of clover and lucerne from different countries. As the available space does not allow us to produce separately the list given by different districts of the same country, we have reserved them for use in a possible later work.

The following arrangements have been made for issuing the works:

(1) Director K. DORPH-PETERSEN, Copenhagen, on Danish, Hungarian, Polish, Czecho-Slovakian, Roumanian, French and Italian red clover seeds.

(2) Chief director, Court-counsellor Dr. v. DEGEN, Budapest, on Hungarian clover and lucerne seeds.

(3) K. LAVESON, on Swedish red clover from Oestergötland and Smäland.

(4) Director Dr. E. KITUNEN, Helsinki, on Finland red clover seeds.

(5) Seed Laboratory, U. S. Department of Agriculture, Washington D.C. on red clover seeds from north, central and western U. S. of North America.

(6) Dr. F. WAHLEN, chief analyst, of the Seed Laboratory, on Canadian red clover seeds.

Thanks are due to them for their assistance.

Several other colleagues have already made known their wish to collaborate on this important question; we may therefore, in the near future, look for the issue of a continuation of the work.

Besides the researches carried out after VOLKART's plan, two works have been undertaken on the determination of the country of origin; they cannot be included in the limits of this publication and therefore follow separately in unchanged form.

LOUIS FRANCOIS: La détermination de la provenance des semences.
WALTER VON PETERY: *Beobachtungen und Forschungen der Fremden Samen (Unkrautsamen), die in den argentinischen Saaten enthalten sind, mit besonderer Berücksichtigung der Herkunft dieser, je nach Verbreitung der betreffenden Unkrautpflanzen in den verschiedenen Gegenden.*

Red clover from Denmark. At the Cambridge Conference Dr. VOLKART was enabled to report on an early research of DORPH-PETERSEN on the country of origin of Danish red clover. The statements made at that time are still valuable for the present researches. The weed flora given in the following list is that belonging to the northern part of middle Europe. Plants requiring warm arid soil are very scarce, if not altogether missing. There are found here separately: *Reseda luteola, Anthyllis Vulneraria, Medicago sativa, Salvia pratensis, Thrincia hirta, Crepis tectorum, Centaurea Scabiosa, Picris hieracioides,* all of which indicate a warmer, drier, somewhat more limy undersoil. Even *Silene dichotoma*, a plant which ought to be considered as continental, was found in two samples. Particularly interesting, as VOLKART already pointed out, is the rather frequent occurrence of *Trifolium striatum* in Danish red clover. This plant is chiefly to be found in Mediterranean lands and West Europe and appears, on the contrary, only very scattered and scarce in central Europe on soils having almost no lime or much salt. The following is worth notice: the very frequent occurrence of *Lolium perenne* and L. *multiflorum, Phleum pratense, Dactylis glomerata, Agropyrum repens, Bromus arvensis, Poa annua* and *P. trivialis* must partly be attributed to the extensive cultivation of these species in Denmark, partly however to the influence of the cool and damp climate of this country. Also the strong predominance of *Geranium dissectum, Geranium molle* and *Geranium pusillum* as well as of *Chrysanthemum inodorum* appears worth of notice.

S w e d i s h r e d c l o v e r f r o m O e s t e r g ö t l a n d a n d S m å l a n d. The weed content of both Swedish areas of origin from Oestergötland and Småland shows the composition that is characteristic of the North of central Europe and is also to be found in Danish seed in which those kinds are scarce that require a warm soil. Apart from such plants stand *Galeopsis Ladanum*, *Anthyllis Vulneraria*, and *Centaurea Scabiosa*; on the contrary *Galium tricorne*, is very frequent, a species originally indigenous to South Europe but is now more or less accustomed to the climate of especially warm places in central Europe. Its frequent occurrence in Swedish red clover fields has yet to be studied. In Danish, and still more in German seeds, various kinds of weeds are totally missing such as *Daucus Carota*, *Crepis tectorum*, *Sherardia arvensis*, *Trifolium striatum*, *T. procumbens* and *T. arvense*, *Silene inflata*, *Reseda luteola*, *Geranium pusillum*, *Scleranthus annuus*, etc. We cannot decide here if this fact is principally due to the more northerly position of these countries in regard to Denmark, or to the little amount of lime in the soil. The almost complete deficiency of *Dactylis glomerata*, *Lolium perenne* and *L. multiflorum* in Swedish seeds should be noted in comparison with Danish seeds in which these kinds occur very frequently.

The weight per thousand seeds of those coming from Oestergötland and Småland shows a noticeable conformity with that of Danish seeds. We note here in accordance with the result already obtained by Dr. VOLKART, that Danish, Dutch and Swedish clover show a dominance of the yellow colour. The regular occurrence of little stones, quartz, feldspar and hornblende is evidently very characteristic in these Swedish seeds and can be taken into consideration in determining the country of origin.

R e d c l o v e r f r o m F i n l a n d. In the weed flora of seeds coming from Finland, as in those coming from Stockholms Län, the influence of the northern climate is very noticeable. Species requiring warm regions are almost completely missing. *Plantago lanceolata* which occurs very frequently in Danish and in Swedish seeds from Småland is much less frequent in Swedish red clover samples from Oestergötland and appears only very rarely in those from Stockholms Län and from Finland. The interesting fact, noted by Dr. VOLKART, that in samples from Stockholms Län the persistent species prevail, is even more noticeable in red clover samples from

Finland. In Finland seed species are even to be found that in central Europe are indicative of specially damp meadows and marshes, e. g. *Stellaria palustris, Galium uliginosum, Filipendula Ulmaria, Achillea ptarmica, Juncus bufonius, Cirsium palustre.*

Very characteristic of Finland red clover is the very frequent occurrence of *Rumex domesticus* that is only to be found in isolated samples from Stockholms Län and can be considered as the indicator of Finland seeds. Worth noticing also is the frequent occurrence of *Galeopsis Tetrahit* and the less frequent of *Carum Carvi*, *Ranunculus acer* and *Lathyrus pratensis*.

The mineral content of the samples is very characteristic and when carefully studied is of great help in determining the country of origin.

Red clover and lucerne from Hungary. The weed flora of Hungary is composed partly of species from central Europe and universal plants, partly of species requiring warmth, as are also to be found in Italian and French seeds, partly of representatives of western and south-western Europe. Contiguous south-western Russia, Roumania and Jugoslavia have equal or similar characteristics and some of the weeds of western Europe go westward through Moravia, Bohemia, Austria, in the dry regions of western Germany.

On account of the frequency of occurrence of various species liking a warm climate it is not always an easy task, as STEBLER and VOLKART note, to distinguish Hungarian and other clover and lucerne seed of eastern Europe, from those of western and south Europe. But these kinds are also of a great help in determining the country of origin, as they respectively appear in the different regions in different proportions. Very characteristic in Hungarian seeds, and in those of the contiguous regions is the frequency of occurrence and the corresponding constancy and dominance of *Setaria viridis*, *Setaria glauca* and *Panicum Crus-galli*. Together with these are frequently found *Setaria germanica* and *Panicum miliaceum*. Other species liking warm soil are more frequent in seeds of eastern Europe than in the seeds of western and south Europe, in greatest quantity were found in the samples: *Chenopodium hybridum*, *Coronilla varia*, *Conium maculatum*, *Lappula echinata*, *Ballota nigra*, *Stachys annua*, *Cichorium Intybus* and in less quantity *Polycnemum majus*, *Delphinium Consolida*, *Nigella arvensis*, *Galega officinalis*, *Bupleurum tenuis-*

simum, *Galeopsis Ladanum* and others. The occurrence also of the Grobseide, *Cuscuta arvensis*, more frequent in Hungarian seeds than in those of western and south Europe, can be used as an indicator. *Hibiscus ternatus*, considered to be a variety of *Hibiscus Trionum* by one author and by another as an independent species and was, up to the present time, termed *Hibiscus Trionum* in the literature of the seed laboratory, is very characteristic of many Hungarian seeds even if it is more rare. We are rather surprised at the occurrence of *Picris echioides* (= *Helminthia echioides*), *Centaurea solstitialis* and *Crepis setosa*. Even if those species, especially both the last ones, can often be observed in Hungary as weeds, the occurrence of their seeds in clover and lucerne seeds suggested up to the present time, a French or Italian origin. Dr. v. DEGEN states in the additional text to his tables of the countries of origin that *Picris echioides* is to be found in lucerne fields of certain regions of Hungary. Also *Verbena officinalis* that, up to the present time, was considered as belonging more to western Mediterranean Atlantic regions, occurs frequently in the list of Hungarian red clover. *Lolium perenne* and *Lolium multiflorum* are, like other herbs, often very frequent in French seeds and become therefore characteristic. But *Lolium perenne* occurs also very frequently in Hungarian red clover lists as, together with *Lolium aristatum*, in the lucerne list. (*Lolium aristatum* is the commonly grown form lasting 2-3 years, of Italian Rye grass). In consequence of this the number is always more reduced of the chief species by means of which the clover and lucerne seeds of western Mediterranean-Atlantic regions differ from those of Hungary.

On the other hand, Hungarian seeds show, together with the above mentioned weeds liking warm soil, specific representatives of the west and south-west, which are missing in French and Italian countries of origin and were in part, up to the present time, altogether unknown for these regions as for instance, *Festuca* [illegible], *Rumex stenophyllus*, *Brassica elongata*, *Trifolium parviflorum*, *Melampyrum barbatum*, *Salvia nemorosa*, *Anthemis ruthenica*, *Centaurea pannonica*, *C. micranthos*. Both the last species have also, as Director VOLKART stated at the Copenhagen International Conference, been found in Roumanian seeds by Director [illegible]. Unfortunately, of these species, only *Centaurea micranthos* and *Rumex stenophyllus* occur frequently in the list of Hungarian lucerne seeds, while they are missing in red clover. On the contrary, *Centaurea pannonica* and *Anthemis ruthenica* are to be found in red clover

seeds among the less frequent kinds, while the other species mentioned occur only in isolated cases and cannot therefore be considered as chief kinds. At all events, in the study of Hungarian seeds special attention should be given to all such species.

A typical representative of Eastern European weeds, *Silene dichotoma*, by means of frequent importation of Russian and Hungarian clover seeds has reached west and north to Bohemia, Silesia, Denmark and Finland, appearing also in North America, as the lists of the countries of origin of the United States of America ascertain. On the other hand, *Amarantus albus* and *A. retroflexus*, weeds originally coming from North America, have largely extended in Hungary and their seeds occur therefore very frequently and can be of great help in determining the country of origin. However, v. DEGEN states in his additional text that *Melilotus parviflorus*, considered in literature as Hungarian yellow clover seed, was never to be found in Hungarian seed and that he was also never able to find the plant among Hungarian weeds. On the other hand, in Hungarian lucerne is to be found the seed of *Trigonella Besseriana* Ser. (= *Melilotus procumbens* Bess.) that somewhat resembles the seed of *Melilotus parviflorus*. The plant does not occur very frequently on the sodium sandy soil of Hungary, but here and there in clusters. Its seeds were rather numerous in the corresponding lucerne seeds, and interesting also is the frequent occurrence of *Salsola Kali* in Hungarian lucerne seeds. This occurs because the soil of the Hungarian plain contains, here and there, a greater quantity of salt.

Even if it is rather difficult, according to the above mentioned works, to distinguish Hungarian from French and Italian seeds and especially to recognize mixtures of both, the examination of the whole seed flora as it appears in the lists, gives a reliable table. According to my own experience, the presence of typical small lumps of earth is of great help, in determining Hungarian seeds. A great quantity of these seeds comes from the region of the Hungarian plain, which is covered with black earth. In the samples it has the form of little round lumps. It differs from the one which occurs in Russian seeds, because the Hungarian particles are more closely united and often show a slightly glossy brilliancy. According to a communication of Councillor v. DEGEN, the difference proceeds from the fact that Hungarian black earth contains sodium.

R e d c l o v e r f r o m t h e U n i t e d S t a t e s o f N o r t h A m e r i c a. The table sent by the Seed Laboratory,

U. S. Department of Agriculture, Washington, D. C., shows in alphabetical order the weed seeds of 133 red clover samples from 14 States and the average number per 1000 gm., as found for each State. Unfortunately, space does not allow us to produce the 14 lists; they are, in consequence of this, assembled in one list. But the memorandum attached to the work has been published without any alteration. It shows in what class the weed content of each State differs and is a compensation for the single lists.

In comparing the following classification of weed seeds with what, in the first International Conference for Seed Testing, of 1907, STEBLER stated to be characteristic of North American origin, we notice a very considerable increase in our knowledge concerning the weed flora of this region. In these American species very frequently occur: *Plantago Rugelii* and *Ambrosia artemisiaefolia*, less frequently: *Panicum capillare*, *Euphorbia Preslii*, *Acalypha virginica*, *Physalis* sp. The following kinds are to be found isolated: *Panicum dichotomiflorum*, *Panicum Gattingeri*, *Panicum lanuginosum*, *Panicum barvipulvinatum*, *Sporobolus clandestinus*, *S. neglectus*, *S. cryptandrus*, *Paspalum setaceum*, *Danthonia spicata*, *Cenchrus tribuloides*, *Polygonum pennsylvanicum*, *Rumex salicifolius*, *Chenopodium leptophyllum*, *Amaranthus blitoides*, *Salsola pestifer*, *Mollugo verticillata*, *Lepidium densiflorum*, *L. virginicum*, *Linum virginianum*, *Euphorbia maculata*, *Cuphea petiolata*, *Oenothera heterophylla*, *Verbena urticifolia*, *V. angustifolia*, *V. hastata*, *Hedeoma pulegioides*, *Lycopus virginicus*, *Dracocephalum parviflorum*, *Trichostema dichotomum*, *Teucrium canadense*, *Solanum carolinense*, *Plantago aristata*, *Veronica peregrina*, *Lobelia inflata*, *Rudbeckia hirta*.

Red clover from Canada. The weed content of Canadian seeds does not contain so many species as in the case of seeds from the United States of America. Out attention is first of all called to the fact that, in the American chief species only *Plantago Rugelii* and *Ambrosia artemisiaefolia* are to be found, and isolated *Sisyrinchium* sp., *Decodon verticillatum* and *Silene antirrhina*. Of the kinds more frequent in the red clover samples of the United States, are missing here: *Amaranthus* sp., *Andropogon Ischaemum*, *Daucus Carota*, *Euphorbia Preslii*, *Physalis* sp. *Acalypha virginica*, *Panicum capillare*.

Comparing the weed contents of the United States and Canada with European red clover seeds, we notice that a great many Euro-

pean species are also to be found among the American seeds, with the same frequency of occurrence as, for instance, *Setaria glauca* and *S. viridis*, *Rumex crispus* and *R. Acetosella*, *Polygonum Persicaria*, *Chenopodium album*, *Plantago lanceolata*, *Cirsium arvense*, etc. On the other hand, a certain number of species and varieties frequently occurring in Europe are totally missing. We cannot find in American lists our species of *Geranium*, *Vicia*, *Galium* and *Centaurea*, *Sherardia arvensis*, *Carum Carvi*, *Sinapis arvensis*, *Convolvulus arvensis*, *Lapsana communis*, *Matricaria inodora*, *Agropyrum repens*. The western and south European chief kinds such as *Coronilla scorpioides*, *Helminthia echioides*, *Picris stricta*, *Thrincia hirta*, *Trifolium supinum*, etc., are also missing. *Ranunculus repens*, *Spergula arvensis*, *Lolium multiflorum* and *Lolium* sp. were only present in every other of the 133 samples of the United States, and in those of Canada are missing; *Cichorium Intybus* is only to be found in isolated cases. The occurrence of *Heleocharis palustris* and *Heleocharis ovata* in American clover seeds is surprising. These plants appear in Europe only in marshes and very damp meadows, on the border of pools or in emptied reservoirs, but never in clover fields.

We possess data respecting samples from Poland, Czechoslovakia, Roumania, Italy and France, but as they do not supply any general conclusions they are only published in the lists as supplements.

LIST I.

Red clover from Denmark.

Examined by DORPH-PETERSEN, Director of Staatsfrökontrollen, Copenhagen.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent:			
Anthemis arvensis L.	39	138 000	7 800
Lolium perenne L. and *L. multifl.* Lam.	38	31 840	6 414
Rumex crispus L.	38	12 200	1.170
Trifolium hybridum L.	38	5 160	285
Medicago lupulina L.	38	4 000	574
Geranium dissectum L.	39	2 000	107
Cirsium arvense (L.) Scop.	38	2 000	250
Chenopodium album L.	37	6 000	1 461
Plantago lanceolata L.	37	3 480	449

	Number of semples	Maximum per 1000 gm	Average per 1000 gm
Very frequent:			
Rumex acetosella L.	35	259 560	8 480
Phleum pratense L.	34	42 600	1 350
Trifolium repens L.	33	6 760	528
Sherardia arvensis L.	33	272	[illegible]
Dactylis glomerata L.	32	20 400	[illegible]
Geranium Molle L.	32	693	[illegible]
Chrysanthemum inodorum L. (= *Matricaria inodora* L.)	32	8 640	[illegible]
Agropyrum repens Krause (= *Triticum repens* L.)	31	4.760	[illegible]
Sinapis arvensis L.	31	1 800	[illegible]
Frequent species:			
Brunella vulgaris L.	29	21 200	[illegible]
Stellaria media (L.) Vill.	28	2 160	[illegible]
Daucus Carota L.	27	17 000	[illegible]
Plantago major L.	24	14 920	[illegible]
Polygonum aviculare L.	23	773	[illegible]
Geranium pusillum L.	21	1 020	[illegible]
Bromus arvensis L.	20	10 240	[illegible]
Less frequent species:			
Poa annua L. a. *P. trivialis* L.	19	33 333	5.848
Agrostis alba L.	19	59 700	5.070
Viola tricolor L.	19	201	[illegible]
Myosotis arvensis Pers.	19	1 140	116
Spergula arvensis L.	19	2 280	306
Trifolium striatum L.	18	987	96
Cerastium caespitosum Gil.	16	1 480	309
Senecio vulgaris L.	17	520	88
Scleranthus annuus L.	14	[illegible]	[illegible]
Ranunculus repens L.	[illegible]	[illegible]	[illegible]
Cirsium lanceolatum (L.) Hill.	15	[illegible]	[illegible]
Silene inflata Smith.	15	420	[illegible]
Capsella Bursa-pastoris Med.	[illegible]	[illegible]	[illegible]
Lotus corniculatus L.	[illegible]	[illegible]	[illegible]
Anagallis arvensis L.	[illegible]	[illegible]	[illegible]
Chrysanthemum Leucanthemum L.	[illegible]	[illegible]	[illegible]
Achillea Millefolium L.	[illegible]	[illegible]	[illegible]
Lolium perenne L.	[illegible]	[illegible]	[illegible]
Veronica Tournefortii Gmel.	[illegible]	[illegible]	[illegible]
Chrysanthemum segetum L.	[illegible]	570	[illegible]
Lapsana communis L.	[illegible]	[illegible]	[illegible]

Isolated species :	Number of samples	Maximum per 1000 gm	Average per 1000 gm
Alchemilla arvensis Scop.	10	640	[illegible]
Galium Mollugo L.	10	76	18
Carex div. spec. (*caespitosa* L., *muricata* L., *rostrata* With., etc.)	8	773	58
Festuca pratensis Huds.	9	1 080	151
Arenaria serpyllifolia L.	8	340	100
Trifolium procumbens L.	9	120	21
Galium Aparine L.	8	72	18
Veronica arvensis L. a. *V. Chamaedrys* L. . .	8	814	179
Cichorium Intybus L.	8	2 680	666
Leontodon autumnalis L.	8	1 560	224
Avena sativa L.	8	24	8
Brassica campestris L.	7	172	42
Holcus lanatus L.	7	173	43
Festuca ovina L., *duriuscula* Koch.	6	52	22
Bromus mollis L. a. *Br. commutatus* Schr . . .	6	128	20
Atriplex patulum L.	7	260	54
Melandryum album Garcke (= *Lychnis alba* Mill.)	6	112	28
Papaver dubium L. a. *P. Argemone* L.	6	5 622	1 200
Triticum vulgare Vill.	6	12	6
Centaurea Cyanus L.	6	52	25
Sonchus asper All.	5	133	62

In 4 samples were found :

Secale Cereale L. (4), *Polygonum Convolvulus* L. (44), *Rumex acetosa* L. (104), *Stellaria graminea* L. (356), *Trifolium arvense* L. (7), *Trifolium agrarium* L. (10), *Anthyllis Vulneraria* L. (13), *Erodium cicutarium* L'Herit. (14), *Reseda luteola* L. (353), *Potentilla procumbens* Sbth. (5), *Echium vulgare* L. (22), *Taraxacum officinale* Web. (4), *Crepis virens* Vill. (83), *Centaurea Scabiosa* L. (5), *Sonchus arvensis* L. (16).

In 3 samples were found :

Alopecurus geniculatus L. (8), *Polygonum tomentosum* Schr. (8), *Ranunculus flammula* L. (4), *Ranunculus sardous* Cr. (= *R. Philonotis* Ehrh.) (12), *Barbarea vulgaris* R. Br. (200), *Sinapis alba* L. (22), *Rubus* sp. (4), *Convolvulus arvensis* L. (4), *Odontites rubra* L. (102), *Stachys palustris* L. (4), *Anchusa officinalis* Garke (4), *Valerianella dentata* Poll. (4), *Bellis perennis* L. (17), *Carduus acanthoides* L. (40), *Artemisia vulgaris* L. (60), *Hypochoeris radicata* L. (40), *Crepis tectorum* L. (6).

In 2 samples were found:

Arrhenatherum elatius M. a. K. (= *Avena elatior* L.) ([illegible] (9), *Luzula campestris* D. C. (6), *Polygonum* [illegible] *toma* Ehrh. (30), *Lychnis* sp. (20), [illegible] (4), *Lepidium campestre* R. Br. (4), [illegible] *Relh.* (8), *Potentilla argentea* L. (400), *Potentilla* [illegible] L. (394), *Veronica hederifolia* L. (6), *Lithospermum arvense* L. [illegible] *plexicaule* L. (54), *Lamium purpureum* L. (4), [illegible] 5), *Sonchus oleraceus* L. (6).

In 1 sample were found:

Airopsis sp. (17), *Triodia decumbens* P. B. (8), [illegible] *Hordeum* sp. (4), *Anthoxanthum* sp. (4), *Lolium temulentum* L. [illegible] sp. (4), *Cynosurus cristatus* L. (9), *Deschampsia caespitosa* P. B. [illegible] *spitosa*, L.) (8) *Bromus* sp. (72), *Alopecurus pratensis* L. (4), [illegible] *Urtica dioica* L. (4) *Polygonum lapathifolium* L. (4), *Polygonum* [illegible] *castrum Pollichii* Sch. et Sp. (4), *Berteroa incana* D. C. (300), [illegible] *trum* L. (36), *Neslea paniculata* Desv. (4), *Sisymbrium* [illegible] *Erophila verna* F. M. (= *Draba verna* L.) (8), *Ornithopus* [illegible] *Melilotus* sp. (4), *Malva silvestris* Fries. (4), *Chaerophyllum* [illegible] (4), *Anthriscus silvestris* Hof. (6), *Torilis Anthriscus* Gemel. [illegible] *minor* Wimm. et Gr. (= *Rhinanthus minor* Ehrh.) (12), [illegible] *Gmel.* (4), *Salvia pratensis* L. (28), *Lamium* sp. (8), [illegible] *Galeopsis dubia* Leers. (4), *Stachys annus* L. (4), *Arctium Lappa* L. [illegible] *rea Jacea* L. (4), *Picris hieracioides* L. (4), *Achillea ptarmica* L. [illegible] *vulgaris* L. (9), *Thrincia hirta* Roth. (12), *Anthemis tinctoria* L. (12), [illegible] *Cotula* L. (5).

The following were also found: *Claviceps purpurea* Tul. in 15 samples (average 43), *Sclerotinia Trifoliorum* Ericks. in 10 samples (average [illegible]), *Typhula trifolii* Rostr. in 12 samples (average 11), other *Sclerotinia* in [illegible] samples (average 45), *Tilletia Holci* Rostr. in 1 sample (4).

In other mixtures were found: Earth, small stones, hull fragments of grain, wasp chrysalis, other chrysalises, larvae and parts of other insects.

Weight per thousand gm: The weight per thousand gm varies from 1.18 to 1.82 gm. and amounts on an average to [illegible] gm.

Colour: The colour has the following percentage average:

	Violet	Prevailing violet	Mixed Violet and yellow	Prevailing yellow	Yellow	Brown	Green
Minimum	[illegible]	[illegible]	[illegible]	[illegible]	8.2	3.7	0.1
Maximum	2.8	40.4	[illegible]	[illegible]	[illegible]	13.5	0.6
Average	1.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The data are derived from 39 samples as regards the weed content, from 10 samples as regards the colour and the weight per thousand gm.

LIST II.

Swedish red clover from Oestergötland

Examined by K. LABESON, Director of the Oestergötlands läns Frökontrollanstalt Linköping.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species :			
Phleum pratense L.	21	95 880	12 819
Trifolium hybridum L.	21	77 920	17 819
Rumex crispus L.	20	3 000	401
Frequent species :			
Chenopodium album L.	16	1 080	164
Medicago lupulina L.	14	19 480	3 074
Polygonum aviculare L.	13	152	47
Sinapsis arvensis L.	13	2 280	203
Galium tricorne Stokes	13	104	39
Less frequent species :			
Thlaspi arvense L.	11	788	136
Lapsana communis L.	11	380	51
Lychnis flos cuculi L.	10	380	75
Plantago lanceolata L.	10	10 500	2 2[illegible]
Cirsium arvense (L.) Scop.	9	188	57
Brunella vulgaris L.	9	212	55
Barbaraea vulgaris R. B.	8	2 4[illegible]	5[illegible]
Stellaria media (L.) Vill.	8	748	183
Agropyrum repens Krause (= *Triticum repens* L.).	7	1[illegible]	43
Rumex acetosella L.	7	274	[illegible]
Spergula arvensis L.	6	1[illegible]	[illegible]
Vicia hirsuta J. F. Gray	6	[illegible]	[illegible]
Chrysanthemum inodorum L. (= *Matricaria inodora* L.)	6	2 5[illegible]	[illegible]
Isolated species :			
Silene nutans L.	5	[illegible]	[illegible]
Carduus crispus L.	5	1 [illegible]	[illegible]
Polygonum lapathifolium L.	4	[illegible]	[illegible]
Stellaria graminea L.	4	[illegible]	[illegible]

Isolated species:	Number of samples	[illegible] per 1000 gm	[illegible] per 1000 gm
Anthriscus silvester Hoff.			
Myosotis arvensis Hill.	4	13	8
Anthemis arvensis L.	4	104	43
Anthemis tinctoria L.	4	732	189
Carex sp.	4	188	106
Poa pratensis L.	3	24	13
Ranunculus repens L.	3	264	176
Viola tricolor L.	[illegible]	[illegible]	[illegible]
Trifolium repens L.	3	26	12
Chrysanthemum Leucanthemum L.	3	24	13
Achillea millefolium L.	3	28	19
Carex hirta L.	3	68	38
Carex muricata L.	2	12	11
Luzula campestris Lam. a. D. C.	2	10	7
Atriplex patulum L.	2	6	6
Cerastium arvense L.	2	244	184
Delphinum consolida L.	2	12	6
Papaver argemone L.	2	34	23
Sisymbrium officinale Scop.	2	28	22
Capsella Bursa-pastoris Medicus	2	148	91
Lepidium campestre R. Br.	2	44	25
Rubus fruticosus L.	2	40	24
Carum Carvi L.	2	4	4
Aethusa Cynapium L.	2	12	9
Pimpinella Saxifraga L.	2	[illegible]	[illegible]
Galium verum L.	2	6	6
Plantago major L.	2	20	16
Odontites rubra L.	2	24	15
Lamium amplexicaule L.	2	28	17
Centaurea cyanus L.	2	12	9
Sclerotien	2	0	5
	2	4	4

Found only in one sample: *Festuca pratensis* Huds. [illegible] *Festuca ovina* L. (28), *Agrostis alba* L. (= *A. stolonifera*) [illegible], *Polygonum Convolvulus* L. (40), *Polygonum Persicaria* L. (6), *Arenaria serpyllifolia* L. (28), *Camelina sativa* Cr. (6), *Potentilla argentea* L. (24), *Geranium* [illegible] *ranium dissectum* L. (13), *Anthyllis vulneraria* L. [illegible] L. (4), *Lithospermum arvense* L. (8), *Galeopsis* [illegible] L. [illegible] *Ladanum* L. (4), *Cirsium lanceolatum* (L.) Hill [illegible] *Leontodon autumnalis* L. (12), *Specularia* sp. (6).

Found in other mixtures: Brown earth, light and darker earth, small pieces of quartz, feldspar, hornblende, clay on the [illegible]

The colour has the following average percentage :

	Violet	Prevailing violet	Prevailing yellow	Yellow
Maximum	[illegible].4	27.5	21.5	52.8
Minimum	12.4	12.[illegible]	8.0	28.8
Average	22.5	19.0	15.4	43.3

The weight per thousand gm. varies from 1.04 gm. to 1.37 gm. and amounts as an average to 1.72.

The data is based on 22 samples from the 1921 and 1922 harvests.

Swedish red clover from Småland.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species :			
Phleum pratense L.	5	602	189
Rumex crispus L.	5	1 300	296
Trifolium hybridum L.	5	15 200	4 571
Plantago lanceolata L.	5	4 600	1 896
Trifolium repens L.	4	112	34
Frequent species :			
Chenopodium album L.	3	300	112
Less frequent species :			
Rumex Acetosella L.	2	48	26
Polygonum aviculare L.	2	28	20
Sinapis alba L.	2	112	61
Vicia hirsuta S. F. Gray	2	20	12
Brunella vulgaris L.	2	12	9
Centaurea Cyanus L.	2	40	26

Isolated species : Found in only one sample : *Poa pratensis* L. ([illegible]), *Dactylis glomerata* L. (20), *Agropyrum repens* Krause (= *Triticum repens* L.) ([illegible]), *Carex muricata* L. (4), *Polygonum lapathifolium* L. (6), *Polygonum Convolvulus* L. ([illegible]), *Barbarea vulgaris* R. Br. (6), *Thlaspi arvense* L. ([illegible]), *Lepidium campestre* R. Br. (92), *Medicago lupulina* L. (12), *Anthyllis Vulneraria* L. ([illegible]), *Silene nutans* L. (12), *Lithospermum arvense* L. (4), *Brunella vulgaris* L. ([illegible]).

In other mixtures were found : Fragments of corn, clay, small pieces of quartz, feldspat, and hornblende, average 0.46 gm.

Weight per thousand gm.: The weight per thousand gm. varies between 1.46 gm. and 1.94 gm. and amounts in average to 1.72 gm.

Colour: The colour has the following average percentage:

	Violet	Prevailing violet	Prevailing yellow	Yellow
Maximum	16.9	34.4	20.3	47.4
Minimum	11.4	22.0	15.7	33.6
Average	14.1	27.8	18.2	39.9

The experiments were carried out on 5 samples of the 1922 crop.

List III.

Red clover from Finland.

Examined by Dr. E. Kitunen, Director of the State Institute for Seed Testing in Finland.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Trifolium hybridum L.	129	83 594	6 306
Phleum pratense L.	127	286 057	16 236
Chenopodium album L.	[illegible]	[illegible]	[illegible]
Rumex domesticus Hn.	99	[illegible]	[illegible]
Spergula arvensis L.	99	9 000	327
Frequent species:			
Galeopsis Tetrahit L.	89	973	81
Rumex Acetosella L.	[illegible]	[illegible]	2 618
Trifolium repens L.	[illegible]	[illegible]	[illegible]
Ranunculus repens L.	72	[illegible]	[illegible]
Less frequent species:			
Polygonum lapathifolium L.	64	1 108	[illegible]
Carum Carvi L.	63	255	32
Stellaria media (L.) Vill.	[illegible]	[illegible]	[illegible]
Polygonum aviculare L.	[illegible]	[illegible]	[illegible]
Rumex crispus L.	57	[illegible]	[illegible]
Brunella vulgaris L.	[illegible]	[illegible]	[illegible]

	Number of samples	Maximum per 1000 gm	Average per 1000 gm
Less frequent species:			
Poa sp. (preferably *pratensis* L., *nemoralis* L., *trivialis* L. and *annua* L.)	53	[illegible]	[illegible]
Ranunculus acer L.	47	[illegible]	[illegible]
Vicia tetrasperma (L.) Moench.	45	[illegible]	[illegible]
Lapsana communis L.	44	[illegible]	[illegible]
Centaurea Jacea L.	44	[illegible]	[illegible]
Luzula campestris (L) D. C.	42	1 840	[illegible]
Agrostis sp. (preferably *vulgaris* With. and *canina* L.).	42	[illegible]	[illegible]
Cirsium arvense (L.) Scop.	42	156	21
Viola tricolor L.	42	216	[illegible]
Thlaspi arvense L.	41	700	[illegible]
Festuca pratensis Huds. (= *F. elatior* L). . .	40	368	24
Chrysanthemum inodorum L. (= *Matricaria inodora* L.)	38	[illegible]	76
Festuca rubra L.	36	314	47
Chrysanthemum Leucanthemum L.	36	[illegible]	142
Linum usitatissimum L.	35	680	[illegible]
Lathyrus pratensis L.	33	326	[illegible]
Isolated species:			
Deschampsia caespitosa (L)	—	—	—
P. B. (= *Aera caespitosa* L.)	32	760	80
Galium Aparine L.	29	188	31
Leontodon autumnalis L.	29	1 320	[illegible]
Stellaria palustris (Murr.) Retz.	28	500	73
Galium Mollugo L.	28	[illegible]	[illegible]
Anthemis arvensis L.	27	[illegible]	[illegible]
Aegopodium Podagraria L.	24	[illegible]	[illegible]
Vicia hirsuta (L.) S. F. Gray	24	80	14
Achillea Millefolium L.	23	[illegible]	[illegible]
Cirsium lanceolatum (L.) Hill.	22	[illegible]	25
Centaurea Cyanus L.	21	[illegible]	[illegible]
Atriplex patulum L.	20	[illegible]	112
Agropyrum repens Krause (= *Triticum repens* L.)	19	[illegible]	[illegible]
Anthriscus silvester (L.) Hoffm.	18	[illegible]	[illegible]
Brassica campestris L.	17	[illegible]	[illegible]
Alectorolophus major (*Ehrh.*) Rehb. and *A. minor* (Erhh.) Wimm. a. Gr. (= *Rhinanthus maior* and *minor* Ehrh.)	17	[illegible]	[illegible]

Less frequent species :	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Pimpinella saxifraga L.	[illegible]	[illegible]	[illegible]
Myosotis arvensis (L.) Hill. (= *M. intermedia* Link)	15	180	29
Bromus secalinus L.	14	28	9
Carex sp.	13	12	8
Erysimum cheiranthoides L.	12	76	23
Rumex acetosa L.	12	30	11
Galium uliginosum L.	11	1 440	143
Barbarea vulgaris R. Br.	10	520	80
Ranunculus auricomus L.	9	104	18
Stellaria graminea L. and *Cerastium caespitosum* Gilib. (= *C. vulgare*)	9	223	59
Alopecurus geniculatus L.	8	45	14
Alopecurus pratensis L.	7	6	4
Polygonum Hydropiper L.	7	28	8
Potentilla Tormentilla Libth.	7	8	5
Filipendula Ulmaria (L.) Max. (= *Ulmaria pentapetala* Gil.)	7	24	9
Plantago maior L.	7	23	11
Stachys paluster L.	7	16	6
Festuca ovina L.	6	8	5
Rubus sp.	6	8	5
Vicia Cracca L.	6	12	6
Anthemis tinctoria L.	6	48	12
Anthoxanthum odoratum L.	5	28	14
Melandrium album (Mill.) Garcke (= *Lychnis alba* Mill.)	5	177	[illegible]
Scleranthus annuus L.	5	36	18
Potentilla argentea L.	5	24	9
Apera Spica venti (L.) P. B.	4	8	7
Trifolium spadiceum L.	4	40	15

In 3 samples : *Dactylis glomerata* L. ([illegible]), *Juncus bufonius* L. (677), *Camelina sativa* (L.) Crantz s. sp., *Alyssum* (Mill.) Thell. (= [illegible]) [illegible] (8), *Potentilla norvegica* L. (21), *Galium verum* L. (44), [illegible] L. (26), *Galeopsis speciosa* Mill. (5), *Achillea* [illegible] L. [illegible] *Lychnis* [illegible] L. [illegible]

In 2 samples : *Fumaria officinalis* L. ([illegible]), *Melandrium rubrum* Garcke [illegible] *dichotoma* Ehrh. (64), *Medicago lupulina* L. [illegible] (34), *Viola canina* L. ([illegible]), [illegible] L. [illegible] (6), *Sonchus arvensis* L. (4), *Crepis tectorum* L. [illegible] Web. (38).

In 1 sample : *Polygonum Convolvulus* L. (12), *Raphanus Raphanistrum* L. (7), *Plantago lanceolata* L. (32), *Euphrasia officinalis* L. (4), *Hieracium umbellatum* L. (6).

In 44 % of the samples *Claviceps* sp. was found, sometimes also *Sclerotinia Trifoliorum* Erikss. and rarely *Typhula Trifolii* Rostr. Chrysalises of different forms are often found here, but cannot be determined ; the most frequent is an oval and brown chrysalis, about 3 mm. long and having a white band.

Small pieces of grain, mostly rye, are sometimes to be found.

The data of the research are compiled from 130 samples as regards the weed content, from 58 samples as regards the mineral content.

Minerals :

Minerals	Number of samples in which the mineral was contained	Maximum percentage of grains in the total amount of mineral	Average percentage of grains in the total amount of mineral	Microscopic dust of stones and grey clay. Sometimes also brick earth.
Quartz (1)	57	60	25	
Feldspar (2)	57	42	17	
Mica (3)	11	3	2	
Quartz-feldspar-mica (4) . . .	58	100	15	
Mica-amphibole-Pyroxene (5).	50	37	13	

(1) Generally white-grey, light watery-grey.

(2) Contains two kinds, hardly separated : Potash-feldspar, of a light brown or reddish colour and plagioclase, soda-lime feldspar which are white, whitish or grey.

(3) Is exclusively composed of dark biotite mica.

(4) Particles containing these elements have been grouped together. The group contains chiefly granite and gneiss ; the chemical composition is almost the same as that of quartz granite.

(5) Contains particles of dark minerals of biotite or amphibole and pyroxene, chiefly of mica-schists with a large quantity of mica and other dark schists, and only few igneous, fundamental rocks having the same chemical composition.

The sand grains are square or slightly rounded.

List IV.

Red clover from Hungary.

Examined by Court Councillor Dr. v. Degen Chief Director of the State Institute for Seed Testing, Budapest.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Lolium perenne L.	8	600	[illegible]
Setaria glauca (L.) R. et Sch.	8	200	114
Setaria viridis (L.) R. et Sch.	8	[illegible]51	[illegible]
Polygonum aviculare L.	8	[illegible]	41
Chenopodium album L.	8	1 11[illegible]	[illegible]85
Trifolium hybridum L.	8	1 2[illegible]	[illegible]68
Medicago lupulina L.	8	900	[illegible]
Daucus Carota L.	8	7 800	[illegible]
Cuscuta arvensis Beyr. v. *calycina* Engelm.	8	10 200	[illegible]
Cuscuta trifolii Bab.	8	29 800	12 [illegible]12
Plantago lanceolata L.	8	43 700	[illegible]
Cichorium Intibus L.	8	1 [illegible]00	[illegible]25
Panicum Crus-galli L. (= *Echinochloa Crus-galli* L.) R. et Sch.	7	100	5[illegible]
Rumex Acetosa L.	7	600	[illegible]
Medicago sativa L.	7	5 000	[illegible]
Trifolium repens L.	7	[illegible]	24[illegible]
Frequent species:			
Atriplex hastatum L. a. *A. patulum* L.	6	5[illegible]	[illegible]
Anagallis arvensis L.	6	2[illegible]	[illegible]
Verbena officinalis L.	6	1 4[illegible]	[illegible]
Digitaria sanguinalis (L.) Scop.	5	1[illegible]	[illegible]
Silene dichotoma Ehrh.	5	[illegible]	12[illegible]
Rumex Acetosella L.	5	2[illegible]	12[illegible]
Melilotus officinalis L.	5	[illegible]	[illegible]
Convolvulus arvensis L.	5	2[illegible]	[illegible]
Brunella vulgaris L.	5	1 [illegible]	[illegible]
Chrysanthemum inodorum L. (= *Matricaria inodora* L.)	5	1[illegible]	52
Less frequent species:			
Amarantus retroflexus L.	4	[illegible]	[illegible]
Sinapis arvensis L.	4	[illegible]	[illegible]
Lotus corniculatus L.	4	[illegible]	[illegible]
Echium vulgare L.	4	[illegible]	[illegible]

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Less frequent species:			
Cirsium arvense (L.) Scop.	4	600	185
Reseda lutea L.	3	200	113
Trifolium arvense L.	3	300	140
Coronilla varia L.	3	100	47
Conium maculatum L.	3	40	20
Myosotis arvensis (L) Hill.	3	200	76
Stachys annua L.	3	100	46
Galium Aparine L.	3	100	40
Anthemis ruthenica M. B.	3	400	170
Centaurea pannonica (Heuff.) Simk.	3	50	40
Crepis setosa Hall. fil.	3	200	103
Lactuca saligna L.	3	100	70
Isolated species:			
Scleranthus annuus L.	2	10	10
Melandrium album (Mill.) Garcke	2	200	120
Ranunculus sardous Cr. (= *R. Philonotis* Ehrh.)	2	40	30
Nigella arvensis L.	2	100	100
Delphinium Consolida L.	2	10	10
Anthyllis Vulneraria L.	2	10	10
Galega officinalis L.	2	30	20
Torilis arvensis (Huds.) Gren.	2	10	10
Galeopsis Ladanum L.	2	100	55
Calamintha Acinos (L.) Clairv.	2	10	10
Melampyrum barbatum W. K.	2	10	10
Anthemis Cotula L.	2	100	100
Centaurea Cyanus L.	2	100	60
Carduus acanthoides L.	2	100	60

The following were found in 1 sample:

Bromus secalinus L. (100), *Festuca pseudovina* Hack. (10), *Polycnemum majus* A. Br. (10), *Vaccaria parviflora* Mnch. (20), *Thlaspi arvense* L. (20), *Lepidium Draba* L. (50), *Lepidium campestre* (L.) R. Br. (200), *Erysimum repandum* L. (30), *Camelina microcarpa* Andrez. (10), *Rubus caesius* L. (10), *Vicia angustifolia* L. (10), *Lathyrus Aphaca* L. (10), *Hibiscus ternatus* Cav. (10), *Viola arvensis* Murr. (100), *Thymelaea Passerina* (L.) Coss. (10), *Lythrum hyssopifolia* L. (40), *Chaerophyllum bulbosum* L. (100), *Pimpinella Saxifraga* L. (100), *Lappula echinata* Gilib. (= *Lithospermum Lappula* Lehm.) (10), *Lithospermum arvense* L. (40), *Lamium amplexicaule* L. (10), *Salvia nemorosa* L. (200), *Sideritis montana* L. (10), *Solanum nigrum* L. (10), *Kickxia Elatine*

(L.) Durn. (40), *Galium Mollugo* L. (100), *Valerianella dentata* Poll. (100), *An-themis austriaca* Jacqu. (100), *Chrysanthemum Leucanthemum* L. (10), *Picris hieracioides* L. (300), *Sonchus arvensis* L. (10), *Sonchus* [illegible] L. [illegible]
The examination was based on 8 samples of 100 gm. and calculated to 1000 gm.

Lucerne from Hungary.

Examined by Court Councillor Dr. v. DEGEN, Chief Director of the Institute for Seed Testing, Budapest.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Setaria viridis (L.) R. et Sch.	8	18 900	11 580
Panicum miliaceum L.	8	290	105
Panicum Crus galli L. (= *Echinochloa Crus-galli* (L.) R. et Sch.)	8	820	229
Atriplex hastatum L. a. *A. patulum* L.	8	[illegible]	[illegible]
Chenopodium album L.	8	[illegible]	[illegible]
Polygonum aviculare L.	8	360	232
Coronilla varia L.	8	360	195
Trifolium pratense L.	8	18 800	4 488
Lotus corniculatus L.	8	980	351
Plantago lanceolata L.	8	3 980	1 756
Stachys annua L.	8	140	54
Setaria germanica (Mill.) P. B.	7	170	51
Lolium aristatum Lag. a. *L. perenne* L.	7	650	[illegible]
Malva neglecta Wallr.	7	120	43
Daucus Carota L.	7	420	124
Cichorium Intibus L.	7	1 830	35
Frequent species:			
Chenopodium hybridum L.	6	5 080	860
Melilotus officinalis L.	6	34 800	11 805
Ballota nigra L.	6	60	26
Digitaria sanguinalis (L.) Scop.	[illegible]	60	24
Rumex stenophyllus Led.	[illegible]	[illegible]	[illegible]
Melandrium album (Mill.) Garcke	5	230	74
Medicago lupulina L.	5	60	38
Cuscuta trifolii Bab.	5	3 600	798
Amarantus albus L. a. *A. retroflexus* L.	4	680	250
Polycnemum majus A. Br.	4	20	12
Trifolium repens L.	4	140	62
Lappula echinata Gilib.	4	50	27

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Frequent species:			
Setaria glauca (L.) R. et Sch.	3	4 330	1 516
Salsola kali L.	3	100	40
Sinapis arvensis L.	3	310	126
Bupleurum tenuissimum L.	3	60	30
Conium maculatum L.	3	20	20
Solanum nigrum L.	3	60	27
Cuscuta arvensis Beyr. v. *calycina* Engelm. . .	3	430	153
Brunella vulgaris L.	3	50	23
Centaurea micranthos G.	3	30	17

The following were found in 2 samples. *Polygonum Convolvulus* L. (20), *Stellaria media* (L.) Voll. (10), *Delphinium Consolida* L. (15), *Brassica campestris* L. (215), *Lepidium Draba* L. (10), *Thalaspi arvense* L. (15), *Trifolium parviflorum* Ehrh. (10), *Vicia tetrasperma* (L.) Mnch. (15), *Geranium pusillum* Burm (10), *Falcaria vulgaris* Bernh. (15), *Verbena officinalis* L. (40), *Ajuga Chamaepitys* (L.) Schreb. (20), *Sideritis montana* L. (20), *Kickxia spuria* (L.) Dum. (15), *Galium Aparine* L. (30), *Galium tricorne* With (10).

Found in 1 sample: *Sorghum vulgare* Pers. (20), *Rumex Acetosa* L. (30), *Nigella arvensis* (10), *Brassica elongata* Ehrh. (10), *Capsella Bursa-pastoris* L. (170), *Reseda lutea* L. (10), *Trifolium fragiferum* L. (20), *Trifolium arvense* L. (50), *Trifolium striatum* L. (10), *Trifolium hybridum* L. (10), *Erodium cicutarium* (L.) L'Herit. (10), *Hibiscus ternatus* Cav. (10), *Pimpinella saxifraga* L. (80), *Lithospermum arvense* L. (20), *Galium verum* L. (10), *Salvia verticillata* L. (40), *Anthemis arvensis* L. (10), *Matricaria inodora* L. (40), *Centaurea pannonica* (Heuff.), Simck. (170), *Centaurea solstitialis* L. (20), *Cirsium arvense* (L.) Scop. (50), *Picris hieracioides* L. (40).

The examination was based on 8 not cleaned samples of 100 gm. and calculated to 1000 gm.

Red clover from Hungary.

Sent by Court Councillor Dr. v. Degen, examined by Director Dorph-Petersen, Copenhagen.

The examination was made on 2 samples of 100 gm. and calculated to 1000 gm:

Average found: *Panicum Crus-galli* L. (12), *Setaria viridis* (L.) P. B. and *S. pumila* Schinz et Thell. (47), *Rumex crispus* L. (32), *Polygonum aviculare* L. (20), *Chenopodium album* L. (18), *Lepidium Draba* L. (244), *Thlaspi arvense* L. (15), *Medicago sativa* L. (1437), *Lotus corniculatus* L. (40), *Plantago lanceolata*

L. (3110), *Anagallis arvensis* L. and *A. caerulea* Schreb. (110), *Lappula echinata* Gil. (= *Echinospermum Lappula* Schm.) (25).

Found in 1 sample: *Panicum sanguinale* L. *Panicum violaceum* Rottl. (5), *Panicum* sp. peeled (5), *Lolium* sp. (115), *Hordeum iubatum* D. C. (5), *Polygonum Convolvulus* L. (5), *Atriplex patulum* L. (20), *Delphinium* sp. (5), *Silene inflata* Smith (10), *Sinapsis arvensis* L. (45), *Trifolium repens* L. (5), *Trifolium hybridum* L. (5), *Trifolium fragiferum* L. (10), *Trifolium multistriatum* Koch (5), *Medicago lupulina* L. (90), *Melilotus* sp. (170), *Coronilla varia* L. (5), *Malva silvestris* Fries (5) *Malva neglecta* Wallr. (5), *Hibiscus Trionum* L. (5), *Daucus Carota* L. (387), *Convolvulus arvensis* L. (135), *Cuscuta* sp. (5), *Lithospermum arvense* L. (5), *Stachys annuus* L. (10), *Sideritis montana* L. (5), *Ballota nigra* L. (5), *Galium Aparine* L. (5), *Galium caudatum* Boiss. (5), *Cichorium Intybus* L. (55), *Cirsium arvense* (L.) Scop. (65), *Picris echioides* L. (= *Helminthia echioides* Gaertn). (5).

In other mixtures were found: Earth, small stones, hulls, broken grains, parts of insects.

LIST V.

Red clover from north central and eastern United States of America.

Examined by the Seed Laboratory U. S. Department of Agriculture Washington D. C.

	Number of samples	Maximum average per 1000 gm.	Minimum average per 1000 gm.
Very frequent species:			
Phleum pratense L.	122	101 04[illegible]	[illegible]
Setaria viridis L. (*Chaetochloa viridis* (L.) Scribn.)	[illegible]	[illegible]	[illegible]
Trifolium hybridum L.	112	61 080	40
Plantago Rugelli Decaisne	112	225 760	200
Frequent species:			
Plantago lanceolata	94	230 320	1 080
Polygonum Persicaria L.	[illegible]	[illegible]	[illegible]
Setaria glauca (L.) P. B. (= *Chaetochloa lutescens* (Weigel) Stuntz)	[illegible]	[illegible]	[illegible]
Rumex crispus L.	[illegible]	[illegible]	[illegible]
Trifolium repens L.	[illegible]	[illegible]	[illegible]
Ambrosia artemisiaefolia L. (= *Ambrosia elatior* L.)	[illegible]	[illegible]	[illegible]
Amarantus sp.	[illegible]	[illegible]	[illegible]
Chenopodium album L.	[illegible]	[illegible]	[illegible]
Andropogon Ischaemon L. (= *Syntherisma Ischaemon* (Schrad.) Nash.)	[illegible]	[illegible]	[illegible]

	Number of samples	Maximum average per 1000 gm	Minimum average per 1000 gm
Less frequent species:			
Daucus Carota L.	60	32 080	40
Euphorbia Preslii Guss.	57	25 120	8
Melilotus sp.	49	36 400	40
Digitaria sanguinalis (L.) Scop. sp. (= *Syntherisma sanguinalis* (L.) Dulac.	46	9 200	10
Panicum Crus-galli L. = *Echinochloa Crus galli* (L.) Beauv.)	46	920	120
Physalis sp.	45	11 920	80
Acalypha virginica L.	41	2 160	7
Panicum capillare L.	41	23 600	4
Medicago sativa L.	38	16 400	20
Polygonum aviculare L.	34	880	4
Rumex obtusifolius L.	34	1 160	13
Isolated species:			
Melandrium noctiflorum (L.) Fr. (= *Silene noctiflora* L.)	31	400	6
Rumex acetosella L.	30	2 560	4
Brunella vulgaris L.	28	720	13
Polygonum Convolvulus L.	27	320	20
Potentilla norvegica var. *hirsuta* Torey et Grey (= *Potentilla monspeliensis* L.)	27	2 060	13
Lactuca Scariola L.	26	560	7
Panicum dichotomiflorum Michx.	24	3 760	20
Polygonum Hydropiper L.	22	320	13
Cuscuta arvensis Beyrich.	22	87 200	40
Lepidium campestre (L.) R. Br.	21	[illegible]	5
Medicago lupulina L.	21	880	10
Malva rotundifolia L.	21	320	5
Nepeta Cataria L.	21	80	5
Hedeoma pulegioides (L) Pers.	21	13 280	10
Poa compressa L.	20	1 040	6
Plantago major L.	19	33 280	40
Lepidium virginicum L.	18	5 360	8
Agrostis alba L. (= *Agrostis palustris* Huds.)	[illegible]	[illegible]	[illegible]
Lepidium apetalum Willd. (1)	[illegible]	[illegible]	[illegible]
Verbena urticifolia L.	[illegible]	[illegible]	[illegible]
Rumex sp. (decort.)	[illegible]	[illegible]	[illegible]

(1) *Lepidium apetalum* Willd. is, in Hegi "*Illustr. Flora von Mitteleuropa*" Bd. IV, 1, a Central and East Asiatic plant. The North American plant is *Lepidium apetalum* [illegible] Aschers. ex p. et auct. Germ. et Amer. = *L. densiflorum* Schrader.

Rare species:	Number of samples	Maximum average per 1000 gm.	Mininum average per 1000 gm.
Melandrium album (Mill) Garcke (= *Lychnis alba* Mill.)	16	560	40
Plantago aristata Michx	16	5 120	4
Panicum Gattingeri Nash	15	8 080	10
Oxalis stricta L.	15	3 760	7
Cirsium arvense (L.) Scop.	15	120	80
Chenopodium sp. (pitted)	14	880	7
Anthemis Cotula L.	14	560	7
Poa pratensis L.	13	[illegible]	[illegible]
Sporobolus clandestinus (Spreng.) Hitchc	13	[illegible]	[illegible]
Oenothera biennis L. (*Onagra biennis* L.)	13	800	20
Sida spinosa L.	13	760	6
Panicum barbipulvinatum Nash	12	[illegible]	40
Solanum carolinense L.	9	200	40
Triticum vulgare L. (= *Triticum aestivum* L.)	8	[illegible]	[illegible]
Sinasis arvensis L. (= *Brassica arvensis* L.) Kuntze	8	120	6
Cerastium glomeratum Thuill. (= *Cerastium vulgatum* L.)	8	240	13
Verbena angustifolia (L) Michx.	8	440	13
Cichorium Intibus L.	8	40	4
Sporobolus neglectus Nash.	7	120	40
Verbascum sp.	7	14 000	40
Cirsium lanceolatum (L.) Hill	7	40	13
Paspalum setaceum Michx.	6	360	10
Atriplex hastatum L.	6	120	7
Chenopodium sp. (poor spec.)	6	[illegible]	40
Brassica sp.	6	40	[illegible]
Euphorbia maculata L.	6	40	6
Chrysanthemum Leucanthemum L.	6	[illegible]	[illegible]
Panicum sp. (small, *Gattingeri*)	5	[illegible]	[illegible]
Poa sp. (decort.)	[illegible]	[illegible]	[illegible]
Bromus secalinus L.	5	[illegible]	[illegible]
Lolium sp.	5	[illegible]	[illegible]
Avena sativa L.	5	[illegible]	[illegible]
Polygonum lapathifolium L.	5	80	40
Trichostema dichotomum L.	5	[illegible]	[illegible]
Carex sp. (*Cephalophora* type)	5	[illegible]	[illegible]
Anagallis arvensis L.	[illegible]	[illegible]	[illegible]
Eleusine indica L. Gaertn.	4	[illegible]	[illegible]
Eragrostis sp.	4	[illegible]	[illegible]

	Number of samples	Maximum average per 1000 grs.	Minimum average per 1000 grs.
Rare species:			
Setaria italica (L.) P. B. (= *Chaetochloa italica* (L.) Scribn.	4	40	—
Dactylis glomerata L.	4	40	—
Poa nemoralis L.	4	40	—
Silene dichotoma Ehrh	4	40	4
Silene vulgaris (Moench) Garcke (= *Silene latifolia* (Mill) Britten and Rendle)	4	200	40
Barbaraea praecox R. Br. (= *Campe verna* (Mill.) Heller)	4	120	80
Erysimum cheiranthoides L. (= *Cheirinia cheiranthoides* (L.) Link)	4	280	80
Sisymbrium officinale (L.) Scop. (= *Erysimum officinale* L.)	4	280	13
Rubus sp.	4	20	4
Dipsacus silvester Huds.	4	80	—
Verbena hastata L.	4	200	4

Found in 3 samples:

Panicum lanuginosum Ell. (120-7), *Panicum* sp. (decortic.) (720-200), *Heleocharis ovata* R. Br. (= *Eleocharis obtusa*) (40-13), *Cyperus* sp. (840-40), *Chenopodium leptophyllum* Nutt. (240-8), *Polygonum* sp. (*decort.*) (120-13), *Capsella Bursa pastoris* (L.) Med. (= *Bursa Bursa pastoris* (L.) Britton (80-7), *Trifolium* sp. (small, like *Trifolium arvense*) (280), *Geum* sp. (40), *Dracocephalum parviflorum* Nutt. (40), *Teucrium canadense* L. (40-20), *Aster* sp. (40), *Anthemis arvensis* L. (320-6).

Found in 2 samples:

Agrostis sp. (decortic.) (20-10), *Danthonia spicata* (L.) Beauv. (7-6), *Sporobolus cryptandrus* (Torr.) Gray (40-8), *Amarantus blitoides* S. Wats. (10), *Polygonum* sp. (like one in Argentine alfalfa) (40-8), *Salsola pestifer* A. Nels. (40-5), *Potentilla* sp. (40-5), *Trifolium dubium* Sibth. (13-6), *Trifolium procumbens* L. (7), *Melilotus albus* L. (400), *Linum usitatissimum* L. (80-40), *Cuphea petiolata* Koehne (13-4), *Oenothera heterophylla* Spach. (= *Raimannia laciniata* Rose) (40-20).

Found in 1 sample:

Leersia sp. (7), *Cynodon Dactylon* (L.). Pers. (= *Capriola Dactylon* (L.) Kuntze) (80), *Cenchrus tribuloides* L. (40), *Deschampsia caespitosa* (L.) P. B. (= *Aira caespitosa* L.) (40), *Arrhenatherum elatius* (L.) Mert. et Koch. (8), *Bromus tectorum* L. (4) *Bromus* sp. (decort.) (5), *Festuca arundinacea* Vill.

(13), *Festuca pratensis* Huds. (= *Festuca elatior* L.) (13), *Vulpia Myurus* Gmel (= *Festuca Myurus* L.) (40), *Lolium multiflorum* Lam (10), *Secale cereale* L. (20), *Hordeum vulgare* L. (40), *Hordeum* sp. (20), *Carex* sp. (3 angular concave faces) (80), *Carex* spec. (3 angled faces not concave) (13), *Heleocharis palustris* (L.) R. Br. (= *Eleocharis palustris* (L.) R. et S.) (40), *Rumex salicifolius* Weinm. (80), *Polygonum pennsylvanicum* L. (10), *Mollugo verticillata* L. (40), *Stellaria media* (O.) Vill. (= *Alsine media* L.) (6), *Dianthus Armeria* L. (200), *Spergula arvensis* L. (40), *Ranunculus repens* L. (4), *Thalaspi arvense* L. (15), *Brassica juncea* (L.) Coss. (80), *Brassica nigra* (L.) Koch (700), *Camelina microcarpa* Andr. (20), *Sisymbrium altissimum* L. (= *Norta altissima* (L.) Britton (80), *Rosa* sp. (13), *Trifolium incarnatum* L. (4), *Melilotus officinalis* L. (5), *Linum virginianum* L. (360), *Hibiscus Trionum* L. (7), *Lythrum hyssopifolia* L. (13), *Lithospermum arvense* L. (5), *Lappula echinata* Gilib. (7), *Echium vulgare* L. (120), *Lycopus virginicus* L. (120), *Solanum nigrum* L. (80), *Veronica peregrina* L. (7), *Lobelia inflata* L. (40), *Cephalaria* sp. (4), *Rudbeckia hirta* L. (40), *Helianthus annuus* L. (5), *Erigeron* sp. (230), *Artemisia* sp. (5), *Senecio* sp. (4), *Chrysanthemum* sp. (20), *Sonchus asper* (L) Hill. (200), *Taraxacum corniculatum* D. C. (= *Leontodon levigatum* Willd.) (4), *Taraxacum officinale* Web (= *Leontodon Taraxacum* L.) (10), *Hieracium* sp. (4).

Memorandum in regard to examination of Red Clover Samples in accord with the plan proposed by R. VOLKART. *Seed Laboratory, U. S. Department of Agriculture, Washington, D. C.*

The table herewith submitted is a list of the foreign seeds occurring in one hundred and thirty three samples of red clover seed grown in the north central and eastern United States. The examination of these samples and the tabulation made, represents what has been done so far in the effort to carry out the plan for an exhaustive study of the foreign seed content of certain agricultural seeds produced in the different countries, with the purpose of determining the diagnostic value of the incidental seeds occurring in forage crop seed in determining the country of origin.

Past experience has shown that red clover seed grown in North America can be determined as coming from three distinct regions. The largest and most important region extends from the north central States of North Dakota and Minnesota, southward to Missouri and Kentucky, eastward to Ontario, Canada, New York, Pennsylvania, Maryland and Virginia. The other two regions are in the north-western States, one west of the Cascades in Oregon, the other in Idaho and central and eastern Washington.

The seed from this first mentioned region was represented in this investigation by one hundred and thirty three samples. These samples were from fourteen States and the number from each State was as follows: North Dakota 3, Minnesota 5, Michigan 12, Wisconsin 14, Illinois 10, Iowa 9, Missouri 5, Indiana 13, Ohio 34, Kentucky 3, Pennsylvania 1, Maryland 6, Virginia 15, New York 3. With the exception of six samples, all were over 250 grams in weight. The samples were not cleaned but examined just as they were submitted. Some were quite weedy and others very clean.

The method of examining samples was as follows. As most samples were about a pound in weight, the samples were put through the sampling machine and a sample of 250 grams was taken. This 250 grams was divided into 10 equal parts of approximately 25 grams each. The first 25 grams was divided into two parts and the first part examined weighed exactly 12.5 grams. From the first 12.5 grams all incidental seeds were removed and counted. All incidental seeds found in the second 12.5 grams were removed and counted with the exception of those seeds which numbered more than 25 in the first 12.5 grams. The number of each kind of incidental seeds in 1000 grams was estimated from the number in the first 12.5 grams if they numbered more than 25 in that quantity, or if less, the estimate was made from the number of seeds found in 25 grams. The other portions of 25 grams each were examined for additional kinds of incidental seeds. Of the kinds of seeds not found in the first 25 grams no count was made, but a record was made of the portions examined before the seed was found. For example, if a new kind of seed was found in the fourth portion examined, the record was made that one seed was found in 100 grams. This would be equivalent to ten seeds in 1000 grams. This method differs from the method proposed by Dr. Volkart. The method of Dr. Volkart requires the removal and counting of all seeds from the entire 250 grams until 50 seeds of each kind was found.

The examination of these samples afforded an opportunity to determine the possibility of identifying the seed from the different parts of this large region. A study of the tabulation shows that most of the incidental seeds occurring in seed from the north central and eastern United States are seeds of plants with a very wide distribution. The tabulation, of course, records certain seeds not appearing in seed from all sections of this region, but usually the seeds are of infrequent occurrence or the seed from the region was represented

by only a few samples. Two exceptions might be mentioned. The seeds of *Cirsium arvense* are rarely found in seed grown in the southern half of this region and the seeds of *Panicum latifolium*-*tum* are only found in the western part. A relief map of this region shows the mountains of the Appalachian system rising in New York and extending in a south-westerly direction through the States of Pennsylvania, Maryland, West Virginia, Virginia, Kentucky, North

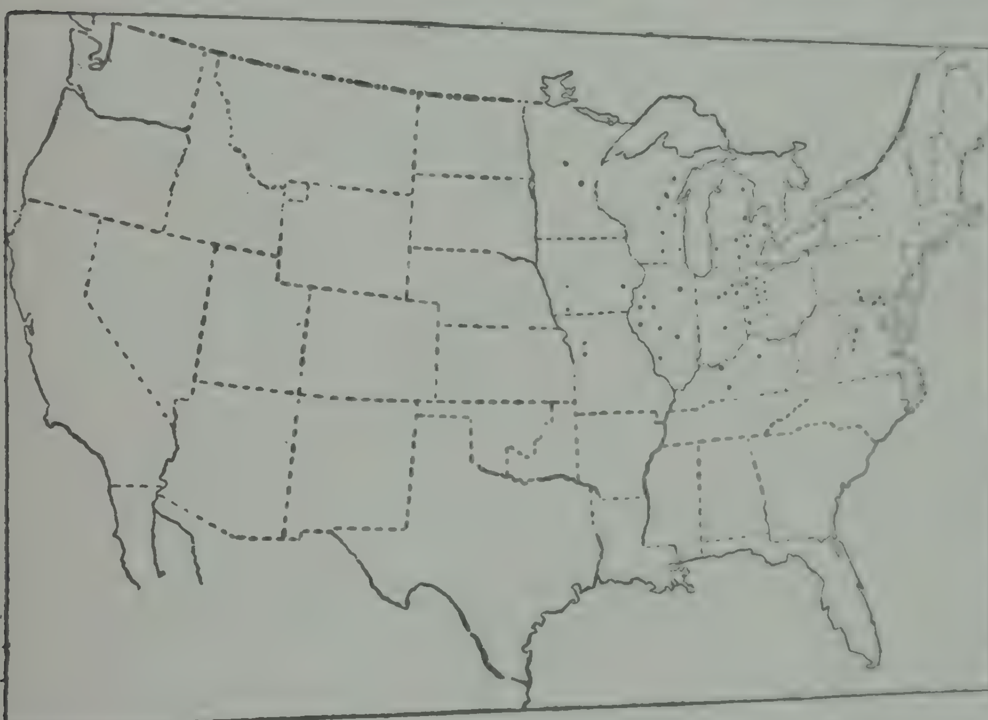

FIG. 288. — Map showing source of samples examined.

Carolina and Tennessee. The flora as exhibited by the weed seed content of red clover seed from the region east of these mountains seems to be the same as that exhibited by the seed from west of these mountains. The seeds of *Trichostema dichotomum* were found in four samples out of fifteen from Virginia, and one sample out of six from Maryland, the seeds of an unknown *Panicum* occurred in the same number of samples from the same locality, and the seeds of an unknown *Trifolium* occurred in three out of fifteen samples from Virginia. These seeds were not found in seed from any other State but the infrequency of their occurrence makes them of little value as diagnostic seeds.

The examination of a large number of samples may show more

definitely the comparative frequency of occurrence of the incidental seeds occurring in seed from different parts of this region, but the information so far shows the great similarity of the foreign seed content of seed from all parts of this large region.

Inert Matter :

In examining the samples a representative part of the inert matter was removed and filed for future study. A glance at the vials shows that the Virginia and Maryland samples contain pieces of clay, quartz and stone that differ considerably from the material removed from the western samples. So far no actual study of the inert matter has been made, but it is planned to report on this in the near future.

Colour and Weight :

It is planned also to study the colour of the different samples and weight per 1000 grains as suggested by Dr. VOLKART.

LIST VI.

Red clover from Canada (Ontario).

Examined by Dr. F. WAHLEN, Chief Analyst in charge of the Seed Laboratory, Ottawa.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very trequent species :			
Plantago Rugelii Done	10	8 000	1 500
Phleum pratense L.	9	1 224	292
Rumex crispus L.	9	260	74
Trifolium hybridum L.	9	11 320	3 415¾
Chenopodium album L.	8	908	[illegible]
Lepidium campestre (L) R. Br.	8	132	37
Medicago lupulina L.	8	2 720	580
Plantago lanceolata L.	8	552	164
Frequent species :			
Trifolium repens L.	7	1 740	408
Melilotus albus Desr.	7	1 200	[illegible]
Setaria glauca (L) P. B.	6	192	58
Polygonum Persicaria L.	6	116	42

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Frequent species:			
Brunella vulgaris L.	6	20	10
Plantago major L.	6	304	78
Less frequent species:			
Setaria viridis (L) P. B.	5	1 780	439
Poa pratensis L.	5	48	16
Rumex acetosella L.	5	20	11
Ambrosia artemisiaefolia L.	5	444	104
Medicago sativa L.	4	1 500	396
Anthemis Cotula L.	4	720	[illegible]
Melandrium noctiflorum (L.) Fr (*Silene noctiflora* L.)	3	36	18
Cirsium arvense (L.) Scop.	3	16	9
Isolated species:			
Panicum Crus galli L. (= *Echinochloa Crus galli* (L.) Beauv.)	2	24	14
Bromus secalinus L.	2	20	14
Sisyrinchium sp.	2	20	12
Polygonum Convolvulus L.	2	12	8
Polygonum Hydropiper L.	2	228	147
Atriplex patulum L.	2	24	20
Nepeta Cataria L.	2	4	8

Found in 1 sample:

Setaria italica (L) P. B. (4), *Digitaria sanguinalis* (L.), Scop. (4), *Decodon verticillatum* (L) Ell. (4), *Poa compressa* L. (28), *Poa compressa* L. ? (68), *Poa pratensis* L. ? (56), *Graminaceae indeterm.* (3), *Carex* sp. typ. *C. Michauxiana* (4), *Heleocharis ovata* (Roth) R. Br. (= *Eleocharis ovata* R. Br.) (4), *Rumex* sp. decortic. (8), *Polygonum aviculare* L. (4), *Polygonum Hydropiper* L. not typical, probably a variety) (20), *Silene antirrhina* L. (4), *Silene inflata* Sm. (*S. latifolia* Britton et Rendle) (12), *Melandrium album* (Mill.) Garcke (= *Lychnis alba* Mill.) (4), *Stellaria media* (L.), Vill. (4), *Cerastium glomeratum* Thuill. (= *C. vulgatum* L.) (4), *Camelina* sp. (40), *Erysimum cheiranthoides* L. [illegible], *Lactuca* sp. ind. (very nearly like [illegible]) *Cirsium lanceolatum* (L.) Hill. (8), (68), *Cichorium Intybus* L. (16).

The following substances were also found :

Mineral and vegetable matter, insects, parts and excrements of insects.

Weight per thousand gm. : Maximum weight [illegible] gm. Minimum weight 1.3599 gm.

Average weight 1.4570 gm.

The following is the average percentage colour with the corresponding weight per thousand gm :

	Violet	Prevailing violet	Violet and yellow mixed	Yellow Prevailing	Yellow	Brown
Maximum	22	271	445	356	290	[illegible]
Weight per 1000 gm.	1.7375 gm	1.6578 gm	1.5615 gm	1.5236 gm	1.4314 gm	1.2857 gm
Minimum	7	117	173	212	169	14
Weight per 1000 gm	1.2583 gm.	1.4288 gm	1.419 gm	1.0621 gm	1.2928 gm	0.8854 gm
Average	12,7	208.2	243.6	275.8	217.6	42.1
Weight per 1000 gm.	1.4275 gm.	1.5409 gm.	1.5086 gm.	1.4024 gm.	1.3654 gm.	1.1389 gm

This result concerns the samples submitted in Ontario 1923 from the oldest and most important red clover producing region of Canada. In Quebec a new district is being opened up for which the necessary researches have been undertaken.

The examination was made with 10 samples of 250 gm. and was calculated to 1000 gm.

List VII.

Red clover from Poland.

Sent by Director W. Weigert, examined by Director Dorph-Petersen, Copenhagen.

The data of the research were based on 2 samples of 175 and 150 gm. and was calculated to 1000 gm.

On the average were found :

Rumex crispus L. and *R. obtusifolius* L. (108), *Polygonum aviculare* L. (21), *Chenopodium album* L. (73), *Sinapis arvensis* L. (27), *Medicago lupulina* L. (9), *Trifolium repens* L. (63), *Lotus corniculatus* L. (6), *Anthyllis Vulneraria* L. (20), *Melilotus* sp. (88), *Ornithopus sativus* Brot. (21), *Convolvulus arvensis* L. (6), *Plantago lanceolata* L. (6440), *Anthemis arvensis* L. (20), *Centaurea Cyanus* L. (6), *Cichorium Intybus* L. (42).

Found in 1 sample :

Avena sativa L. (6), *Carex* sp. *Polygonum Convolvulus* L. (6), *Polygonum tomentosum* Schrank and *P. Persicaria* L. (20), *Silene inflata* Smith (6), *Silene dichotoma* Ehrh. (7), *Scleranthus annuus* L. (6), *Ranunculus* sp. (7), *Vicia hirsuta* (L.) S. F. Gray (7), *Echium vulgare* L. (13), *Lithospermum arvense* L. (7), *Veronica hederifolia* L. (6), *Galium* [illegible] Boiss. (6), *Centaurea Jacea* L. (7), *Cirsium lanceolatum* (L.) Hill. (6).

In addition were found :

Earth, red earth, pebbles, hulls, broken grains, parts of insects

List VIII.

Red clover from Czecho-Slovakia.

Sent by Director E. Vitek, Prague ; examined by Director Dorph-Petersen, Copenhagen.

The examination was made with 3 samples of 100, 150 and 150 gm and was calculated to 1000 gm.

On an average were found :

In 3 samples : *Trifolium repens* L. (180), *Plantago lanceolata* L. (11[illegible]),

In 2 samples : *Rumex crispus* L. (11), *Trifolium hybridum* L. ([illegible]), *Geranium pusillum* L. (28), *Daucus Carota* L. (166).

In 1 sample : *Lolium perenne* L. (13), *Rumex Acetosella* L. ([illegible]), *Polygonum aviculare* L. (7), *Chenopodium album* L. (424), *Silene inflata* Smith ([illegible]), *Silene dichotoma* Ehrh. (270), *Papaver dubium* L. (20), *Sinapsis arvensis* L. (67), *Rubus* sp. (7), *Medicago lupulina* L. (10), *Medicago sativa* L. (1[illegible]), *Anthyllis Vulneraria* L. (20), *Conium maculatum* L. (27), *Cuscuta trifolii* Bab (60), *Galium caudatum* Boiss. (7), *Anthemis arvensis* (7), *Chrysanthemum inodorum* L. (*Matricaria inodora* L.) (7), *Cirsium arvense* (L.) Scop (13), *Cuscuta trifoli* Bab. (13).

In other mixtures were found :

Earth, red earth, pebbles, black pebbles, hulls, fragments, parts of insects.

List IX.

Red clover from Roumania.

Sent by Director J. Enescu, Bucharest.
Examined by Director Dorph-Petersen, Copenhagen.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Setaria panicea. Schinz et Thell. a. *viridis* (L.) P.B.	5	40 160	9 859
Chenopodium album L.	5	630	174
Polygonum aviculare L.	5	260	121
Trifolium repens L.	5	8 440	3 374
Daucus Carota L.	5	11 680	4 432
Plantago lanceolata L.	5	3 240	1 602
Cichorium Intybus L.	5	100	21
Cirsium arvense (L.) Scop.	5	200	72
Rumex crispus L.	4	3 080	1 408
Medicago sativa L.	4		

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Medicago lupulina L.	4	[illegible]	[illegible]
Lotus corniculatus L.	4	[illegible]	[illegible]
Anagallis arvensis L.	4	[illegible]	[illegible]
Veronica Tournefortii Gmel	4	[illegible]	[illegible]
Brunella vulgaris L.	4	[illegible]	[illegible]
Valerianella dentata Poll.	[illegible]	[illegible]	[illegible]
Frequent species :			
Digitaria sp.	3	[illegible]	[illegible]
Lolium sp.	3	[illegible]	[illegible]
Silene inflata Smith	3	[illegible]	[illegible]
Delphinium sp.	3	[illegible]	[illegible]
Thalaspi arvense L.	3	[illegible]	[illegible]
Sinapis arvensis L.	3	[illegible]	[illegible]
Trifolium hybridum L.	3	[illegible]	[illegible]
Melilotus sp.	3	[illegible]	[illegible]
Galium caudatum Boiss.	3	11	7
Stachys annuus L.	3	[illegible]	[illegible]
Galeopsis dubia Leers. or *G. Ladanum* L.	3	[illegible]	15
Anthemis arvensis L.	3	[illegible]	[illegible]
Lapsana communis L.	3	[illegible]	[illegible]
Less frequent species :			
Dactylis glomerata L.	2	[illegible]	[illegible]
Panicum Crus-galli L.	2	[illegible]	[illegible]
Polygonum tomentosum Schr.	2	40	[illegible]
Rumex Acetosella L.	2	[illegible]	[illegible]
Atriplex patulum L.	2	[illegible]	[illegible]
Nigella arvensis L.	2	[illegible]	[illegible]
Ranunculus repens L.	2	[illegible]	[illegible]
Lychnis sp.	2	[illegible]	[illegible]
Scleranthus annuus L.	2	[illegible]	[illegible]
Malva silvestris L.	2	[illegible]	[illegible]
Viola tricolor L.	2	[illegible]	[illegible]
Pimpinella sp.	2	[illegible]	8
Chaerophyllum temulum L.	2	[illegible]	[illegible]
Cuscuta trifolii Bab.	2	[illegible]	[illegible]
[illegible]	2	[illegible]	[illegible]
Chrysanthemum inodorum L. (*Matricaria inodora* L.)	2	[illegible]	[illegible]
Picris hieracioides L.	2	[illegible]	[illegible]
Cirsium lanceolatum (L) Hill	2	[illegible]	[illegible]
Centaurea Jacea L.	2	[illegible]	[illegible]
Sonchus asper L.	2	[illegible]	[illegible]

Found in 1 sample :

Avena sativa L. (11), *Triticum vulgare* Vill. (6), *Cynodon Dactylon* (L.) Pers. (11), *Cynosurus cristatus* L. (6), *Agrostis alba* L. (6), *Bromus arvensis* L. (6), *Carex* sp. (6), *Atriplex hastatum* L. (207), *Polygonum Persicaria* L. (6), *Polygonum Convolvulus* L. (6), *Stellaria media* Vill. (6), *Spergula arvensis* L. (6), *Barbaraea* sp. (17), *Camelina* sp. (6), *Rubus* sp. (6), *Vicia hirsuta* (L.) S. F. Gray (6), *Trifolium procumbens* L. (6), *Trifolium arvense* L. (6), *Coronilla varia* L. (149), *Coronilla scorpioides* L. (6), *Genista tinctoria* L. (6), *Reseda luteola* L. (6), *Geranium dissectum* L. (11), *Erodium cicutarium* (L.) L'Hér. (6), *Euphorbia exigua* L. (17), *Lythrum Hyssopifolia* L. (300), *Aethusa Cynapium* L. (34), *Torilis nodosa* Gaertn. (6), *Convolvulus arvensis* L. (6), *Echium vulgare* L. (103), *Myosotis arvensis* (L.) Hill. (6), *Verbena littoralis* H. B. et K. (13), *Salvia verticillata* L. (6), *Stachys paluster* L. (6), *Ajuga reptans* L. (6), *Rhinanthus apterus* (6), *Melampyrum arvense* L. (17), *Plantago major* L. (6), *Galium Aparine* L. (6) *Galium* sp. (6), *Anthemis Cotula* L. (6), *Centaurea Cyanus* L. (6), *Centaurea Scabiosa* L. (6), *Carduus acanthoides* L. (6) *Lactuca saligna* L. (6), *Leontodon autumnale* L. (6).

Found also :

Claviceps purpurea Tul. in 3 samples (average 13), *Sclerotinia Trifoliorum* Eriks, in 1 sample (average 11), *Sclerotinia* sp. in 2 samples (average 11), *Ustilago Crameri* Körn, in *Setaria* in 3 samples (average 68).

In other mixtures were found :

Earth, pebbles, hulls, broken grain.

The data of the research are based on 5 samples of 175 gm. and calculated to 1000 gm.

LIST X.

Red clover from Italy

Sent by Director F. TODARO, Bologna.

Examined by Director DORPH-PETERSEN, Copenhagen.

2 samples of 150 and 200 gm. ; result calculated to 1000 gm.

Found on average :

Setaria viridis P. B. (28), *Setaria panicea* Schinz et Thell. (110), *Phalaris paradoxa* L. or *Ph. viridis* (= *Setaria viridis* P. B.) (16), *Rumex crispus* L. or *R. obtusifolius* L. (166), *Medicago sativa* L. (8200), *Medicago lupulina* L. (122), *Lotus corniculatus* L. (65), *Melilotus* sp. [illegible], *Geranium dissectum* L. (8), *Convolvulus arvensis* L. (6), *Brunella vulgaris* L. (200), *Plantago lanceolata* L. (8040), *Sherardia arvensis* L. (21), *Picris* [illegible] L. [illegible], *Helminthia echioides* (Gärtn.) (373), *Cichorium Intybus* L. (16).

Found in 1 sample :

Lolium perenne L. (7), *Lolium* sp. (326), *Setaria glauca* P. B. (7), *Setaria panicea* Schinz et Thell. a. *Setaria viridis* P. B. (113), *Polygonum aviculare*

L. (20). *Trifolium hybridum* L. (5). *Galega officinalis* L. (35). *Hedysarum coronarium* L. (180). *Coronilla scorpioides* L. (Koch) (7). *Malva neglecta* Wallr. (7) *Malva silvestris* L. (*mauritiana* L.) (5). *Daucus Carota* L. (50). *Stachys circinata* L'Herit (10). *Galium Mollugo* L. (7). *Valerianella dentata* Poll (5). *Claviceps purpurea* Tull. (5) was also found.

In other mixtures were found : Earth, small stones, hulls, broken grain.

LIST XI.

Red clover from France.

Sent by Professor L. BUSSARD, Paris.
Examined by Director DORPH-PETERSEN, Copenhagen.

Brittany, Dép. des Côtes du Nord.

The result is given from 1 sample of 175 gm. and calculated to 1000 gm.

Medicago sativa L. (800). *Plantago lanceolata* L. (667). *Medicago lupulina* L. (194). *Anthyllis Vulneraria* L. (149). *Daucus Carota* L. (74). *Echium vulgare*, L. (74). *Silene inflata* Smith (63). *Sherardia arvensis* L. (57). *Vicia hirsuta* S. F. Gray (34). *Trifolium incarnatum* L. (34). *Lolium* sp. (cleaned) (23). *Polygonum Convolvulus* L. (23). *Pimpinella magna* L. a. *P. saxifraga* L. (11). *Polygonum aviculare* L. (23). *Cichorium Intybus* L. (23). *Rumex crispus* L. (17). *Sinapis arvensis* L. (17). *Raphanus Raphanistrum* L. (6). *Malva silvestris* Fries (6). *Onobrychis viciifolia* Scop. (6). *Claviceps purpurea* Tull. (6). Earth, pebbles, hull, broken grain.

South-East, Dép. du Tarn.

A sample of 175 gm. was examined and the result calculated to 1000 gm.

Medicago sativa L. (2440). *Plantago lanceolata* L. (1800). *Daucus Carota* L. (206) *Rumex crispus* L. a *R. obtusifolius* L. (46). *Cichorium Intybus* L. (23). *Lotus corniculatus* L. (17). *Lolium* sp. (partly cleaned) (11). *Atriplex patulum* L. (11). *Malva silvestris* Fries (11). *Sherardia arvensis* L. (11). *Silene inflata* Smith (6). *Geranium dissectum* L. (6). *Medicago lupulina* L. (6). *Coronilla scorpioides* L. (6). *Brunella vulgaris* L. (6). *Teucrium Botrys* L. (6). *Picris hieracioides* L. (6).
Earth pebbles, hulls, broken seeds.

Central France.

The result of the examination is based on a sample of 175 gm., and calculated to 1000 gm.

Medicago lupulina L. (333). *Medicago sativa* L. (240). *Plantago lanceolata* L. (194). *Anthyllis Vulneraria* L. (177). *Sinapis arvensis* L. (80). *Brassica campestris* L. (46). *Melilotus* sp. (46). *Rumex crispus* L. (29). *Vicia hirsuta* S. F. Gray (11). *Echium vulgare* L. (11). *Dactylis glomerata* L. (6). *Rumex Acetosella* L. (6). *Scleranthus annuus* L. (6). *Sanguisorba minor* Scop. (6). *Geranium dissectum* L. (6). *Lotus corniculatus* L. (6). *Trifolium hybridum* L. (6). *Daucus Carota* L. (6). *Sherardia arvensis* L. (6). *Teucrium Botrys* L. (6). *Claviceps purpurea* Tull. (6).

Earth, pebbles, hull, broken seeds, parts of insects.

P r o v i n c e, D é p. d e s B o u c h e s - d u - R h ô n e.

The examination was made on 1 sample of 200 gm. and calculated to 1000 gm. *Medicago sativa* L. (1320), *Picris echioides* L. (= *Helminthia echioides* Gärtn.) (195), *Plantago lanceolata* L. (85), *Malva silvestris* (Fries (60), *Anagallis arvensis* L. (50), *Setaria panicea* Schinz et Thell or *viridis* P. B. (10), *Rumex crispus* L. (10), *Polygonum tomentosum* Schrank (10), *Kickxia Elatine* (L.) Dum. (= *Linaria Elatine* Mill.) (5), *Trifolium repens* L. (10), Earth pebbles, hull, broken grain, parts of insects.

Dr. G. GENTNER,

Institute of Plant Cultivation and Protection, Munich.

THE PLACE OF ORIGIN OF SEEDS.

INTRODUCTION.

In the grain trade it is often necessary to study the place of origin of the materials on which transactions will depend, the seeds of the same species of plant having frequently very different values, according to their origin, or the conditions which have prevailed on their formation and at their harvesting.

A very small number of characteristics drawn from the seeds themselves — form, colour, weight, etc... — can, up to a certain point, give sufficiently exact indications, but, as a rule, if a few typical samples be put on one side, collected from well defined yet fairly restricted regions, the indications drawn from the physical characteristics of the grains are not sufficiently definite to deduce from them sufficiently accurate conclusions, even from the commercial point of view. Recourse must therefore be had to an indirect method, consisting solely in the research and examination of the natural impurities, mixed in an almost constant manner with the samples supplied by commerce.

I.

WHAT IS UNDERSTOOD UNDER THE TERM OF IMPURITIES IN THE CLASSIFICATION OF THESE SEEDS.

This term, looked at in its largest acceptation, includes all the mineral and organic bodies which can be found mixed with the pure seeds. Take, for example, an analysis of lucerne (*Medicago sativa* L.) carried out on five grammes of seed as received in commerce. We find, probably, a proportion of 90 per cent. of pure seed, together with 10 per cent of impurities. These include: (1) Organic bodies, damaged lucerne seeds, clover seeds (*Trifolium pratense* L.), black medick (*Medicago lupulina* L.), rib-grass (*Plantago lanceolata* L.), St. Barnaby's thistle (*Centaurea solstitialis* L.), buttercups of various kinds, etc... ; (2) then come mineral

bodies, grains of sand, earth, etc... ; the whole accompanied by various small vegetable fragments.

It is very evident that all these impurities have not an equal importance. First of all, it is convenient to put on one side all those which consist of seeds of good species (seeds of a good type), mixed accidentally with those of lucerne; thus the grains of clover and black medick must be separated from the other seeds belonging to indifferent or even injurious adventitious plants (seeds of a bad type). The analysis must therefore indicate four groups of results, whatever be the form given to its wording:

1st. = Percentage of pure seeds.

2nd. = Percentage (if the quantity of them be sufficient) of other seeds of a good type (1).

3rd. = Percentage (if the quantity of them be sufficient) of the seeds of adventitious plants (1) with special mention of those of the injurious plants.

4th. = Percentage (if any) of mineral matter, vegetable fragments, damaged seeds, etc...

Of course, these groupings are susceptible to modification; in particular, it may become necessary to calculate the rate of a seed of good type and not confine oneself to giving solely the proportion as a whole. This practice applies equally to the seeds of adventitious plants. It is even a rule to be observed, if the quantity of such, or such a one amongst them appears important, and is absolutely essential when it is a question of harmful plants; such are, for example, the various dodders in leguminous plants, rye-grass in cereals, etc... These operations permit of making a report (germination apart) of the value, as far as purity is concerned, of a lot of seed, and it may happen that the latter suffers in consequence a considerable depreciation, or even that it becomes the object of legal proceedings, if the foreign seeds have been obviously added with a fraudulent intention.

II.

Where it is seen that impurities may be [illegible]

The logical conclusion of the foregoing considerations is the following: An ideal lot of seeds intended for commerce should be entirely devoid of foreign seeds and of mineral impurities; and

this must be, or rather this ought to be, the absolute rule, as regards the seeds of injurious plants, parasites or others; moreover, this is often the case as regards dodder. But, putting this case aside, such lots of seed are not met with in commerce, and however much care has been taken in cleaning the raw seed, there is always a certain proportion of impurities mingled with the main bulk, a proportion which the honest merchant should, and can endeavour to reduce to the minimum. Nevertheless, astonishing as it may appear, the presence of impurities is sometimes a fortunate circumstance, for certain of them constitute a striking certificate of authenticity. They often show, in no uncertain manner, the source of a lot of seed, and this is frequently of considerable importance.

III.

The importance of certain impurities.

I could not give better evidence of the very great importance of certain of these impurities than by taking some examples from amongst the most typical which I have encountered in the course of ten years of observation:

First Example: *Manitoba Wheat* (2). — The attention of agriculturists was drawn to this wheat in quite a special manner during the year 1917. As is known, this wheat has a high reputation, and was employed in relatively large quantities for sowing in the spring of the year 1916.

The form of the grain, and the aspect of its fracture, give some indications, but in a general way these characteristics, drawn from the grain itself, are quite insufficient. Very fortunately, owing to the impurities accompanying this wheat, the determination becomes very easy. The following is the list of foreign seeds which are met with in it: Field mustard (*Sinapis arvensis* L.), shepherd's purse (*Thalaspi arvense* L.), panicled neslia (*Neslia paniculata* Desv.), garlic wort (*Erysimum orientale* R. Br.), corn-flower (*Lychnis Githago* Lam.), stick-seed (*Echinospermum Lappula* Lehm.), bindweed (*Polygonum Convolvulus* L.), goose-foot (*Chenopodium album* L.), various dew-grasses (*Setaria* sp.). It is as well to add to this list the few grains of oats and barley, as well as the few flax seeds, which always accompany the preceding impurities.

The combination of all these foreign seeds is absolutely characteristic of these wheats. Three amongst them, however, are particularly interesting, namely, the seeds of *Echinospermum Lappula*, those of the *Neslia paniculata*, and the grains of *Erysimum orientale*.

Amongst the numerous samples which have come under my observation, the presence of these seeds is constant, and indicates that of all the others.

In this connection, I would point out a fact which may be interesting from the point of view of botanical geography. In the most recent floras of France there is sometimes given with great detail the geographical distribution of plant species, not only on the soil of our own country, but over the surface of the whole world; but, none of these excellent works point out the presence of *E. orientale* in North America. Under these circumstances, therefore, and without any doubt, the plant has been introduced there by cultivation since the time when these data relative to its area of extension were collected in the French floras.

Moreover, *E. orientale* has been pointed out in North America and particularly in Canada, in the floras of NATHANIEL LORD BRITTON and ADDISON BROWN (3), who express themselves on this subject in the following manner: "In waste places, Michigan and Minnesota to the Northwest Territory, and from the Atlantic coast from New Brunswick to Pennsylvania. Has recently become a bad weed in the Northwest".

The seeds of the plant are listed moreover, in a collection prepared by the Canadian Department of Agriculture and sent, a few years ago, to the Station d'Essais de Semences at Paris. The same remarks and the same conclusions appear with regard to *Echinospermum Lappula* Lehm, on the subject of which the above mentioned authors express themselves as follows: "In waste places Nova Scotia to British Columbia, south to New Jersey and Nebraska. Naturalized from Europe. Native also of Asia" (4).

It is seen from this example that the study of impurities may lead from entirely practical and utilitarian considerations to views of a much more general nature. I will give other proofs of this in the examples which are about to follow.

SECOND EXAMPLE: *Barley and Oats.* — Here it is a question of a more complex case.

In the course of the last few years, on several occasions, the

Fodder Department of the Administration applied to the Station d'Essais de Semences at Paris to ascertain the place of origin of various lots of oats and barley. The question was important then, because at that time purchases of the cereals in question could only be made from parcels of French origin (5). From various sources, numerous samples were sent to us, which, added to those we already possessed (of authentic origin), constituted a considerable number of lots which were entrusted to me for study. The following are the conclusions reached which are given as I formulated them at the time.

Barley.

The different varieties of barley examined came respectively from the South of France, Algeria, Tunis, Serbia and Australia. To these samples was added a barley said to be from the Danube, without any more definite specification. The species or genus to which belong the various seeds found in a state of impurity, in the lots which I examined, are as follows:

1st: The South of France. — Wheat, rye, field foxtail, *Phalaris brachystachys* Link, *Rapistrum rugosum* Berg and *Rapistrum orientale* D. C., French grass, honey-lotus, *Torilis nodosa*, Gaertn, *Chrysanthemum coronarium* L.

2nd: Algeria and Tunisia. — Hard wheat, English rye-grass (*Lolium perenne* L.), *Phalaris brachystachys* Link, *Rapistrum rugosum* Berg and *Rapistrum orientale* D. C., *Bifora* sp., coriander (*Coriandrum sativum* L.), *Chrysanthemum coronarium* L., beet.

3rd: Danube. — Rye, various dew-grasses, *Rapistrum perenne*, *Saponaria vaccaria* L., hemp, bindweed (*Convolvulus arvensis* L.).

4th: Serbia. — Rye, *Saponaria Vaccaria* L.

5th: Australia. — Small grains of wheat in great quantity.

In examining these different groups of impurities, it is noticed that seeds exist which may serve to unite certain groups and exclude others. Thus, *Rapistrum* permits of the separation of the barleys of Algeria, Tunis and the South of France, from those of the Danube, Serbia and Australia. On the other hand, the seeds of *Bifora* make it possible to separate the barleys of Algeria and Tunis

from those of the South of France. Finally, from the few samples, unfortunately too rare and too small, of Smyrna barley which I have had in my possession, I am almost of opinion that their impurities will cause them to be classed with those of Tunis, in spite of the fact that I have not come across any Krubora seed in them, which is probably only an accident, due to the smallness of the samples.

The classification of all these barleys could therefore be effected in the following manner:

Rapistrum rugosum *Rapistrum orientale* *Phalaris brachystachys* *Chrysanthemum coronarium*	Barleys of countries round the Mediterranean	1. *Krubera leptophylla* - Algeria, Tunisia, Smyrna. 2. Absence of *Krubera* - South of France.
Rapistrum perenne *Setaria* sp. *Saponaria Vaccaria*	Barleys of the Danube	
Numerous small grains of wheat	Barleys of Australia	

Of course, it cannot be expected that absolutely accurate results will be obtained, in consequence of the extent of the area occupied by a number of adventitious species. But such as they are, their accuracy is sufficient for commercial requirements, for the groups obtained bring together the barleys found in analagous climates, and consequently having similar requirements and properties.

IMPORTED OATS.

Investigations carried out in the same manner on imported oats (6) give the following results:

Phalaris brachystachys *Rapistrum orientale* *Krubera leptophylla* *Chrysanthemum coronarium* *Bupleurum protractum*	Algeria and Tunisi[illegible]

Ambrosia artemisiaefolia. Oats stated to be from America.

Do not contain the above impurities	none	*Rapistrum perenne*		- Danube,
		none	*Neslia paniculala*	- Russia and Libau,
			Echynospermum Lappula	- Courland,
				- Reval,
				- Koeingsberg,
				- Danzig.
			None, but much rye-grass	- La Plata.

Lucerne from Turkestan.

The lucerne of Turkestan is only a variety of ordinary lucerne (*Medicago sativa* L.) adapted to the continental climate of Central Asia. Examined closely, as much from the point of view of the seed as of the vegetative part of the plant, it scarcely differs at all from ordinary lucerne; with difficulty there may be found a few vague characteristics in the seeds, but they are so delicate, that one must have been accustomed to the handling of seeds for a long time in order to be able to discover them.

This lucerne is really inferior to French lucerne. The results of experiments carried out at the Station d'Essais de Semences have been decidedly unfavourable to it. Among other disadvantages, it gives less abundant fodder than in the case of the indigenous varieties, and moreover, does not last as long as these. It is therefore of very great interest to be able to distinguish the seeds of Turkestan lucerne. Here again, it is the impurities which enable us to do this, and more especially one of them: the fruits of *Acroptilon Picris* D. C., a plant of the Compositae family, occupying a fairly extensive geographical area, including a large part of Asia Minor, the Cis- and Trans-Caucasus regions; also a part of austro-occidental Persia, as well as the north and centre of this region; and finally Turkestan and Afghanistan.

The fruits of this plant are quite characteristic, and very easy to recognize. They appear in the lots of lucerne as pearl-white achenes, a little larger than the seeds of lucerne; the faces are slightly flattened, and the contour is not symmetrical, one of the sides being more rounded than the other. The upper extremity, which is wider

than the opposite extremity, has a slight conical protuberance, whilst a shallow depression is noticeable at the opposite end.

Once these seeds have been seen, it is impossible to confuse them with other impurities, hence they are quite characteristic.

Determimation of the characteristics of southern seeds of Clover and Lucerne.

These latter studies, as regards the researches to which they have led, are most typical, and show the great importance of botanical geography in the analysis of seeds.

In a general way — all consideration of place being put aside — if there exist at present a certain number of plants which were formerly utilized successfully, and which are now of only very limited importance, in consequence of the enormous area which they have gradually covered, there are others, however, which would not be able to resist the very diverse climatic conditions corresponding to the whole of the cultivated soil of France. The actual limits of the zones of vegetation of these plants can therefore be investigated with the certainty that, as it is not possible for these limits to vary much, the conclusions drawn from the presence of the seeds of these plants will be sound, so long as the diverse biological conditions obtaining at the distribution of these plants remain the same. For all these reasons, and still others which it is unnecessary to examine here, I have been led to make a special study of the actual northerly limits of one leguminous plant, *Coronilla scorpioides* Koch.

According to the information drawn from the most recent floras, this plant occupies a fairly extensive geographical area. M. Rouy, in his *Flore de France*, expresses himself on this subject as follows: "Habitat: Crops, and cultivated districts in the whole of the south and in the west, up to and including la Vendée, extending on the east as far as Saône-et-Loire, in the Centre as far as Cher and Indre-et-Loire. Corsica: Gulf of Boniface (Fliche).

"Geographical area: Mediterranean region of Europe and Africa, Asia Minor, Caucasus, Persia, Syria and Palestine."

Moreover, prior to this, Lecoq (1856) gave the following particulars relative to the limits of extension of the species: South, Cyprus, 35° — North, France, 46° — West, Portugal, 10° — East, Georgia, 46° E.

What interests us being the northern limit in France of the zone of vegetation of this plant, and its presence on fields of clover and lucerne, I have tried to obtain more exact data. The local floras have supplied me with a fair amount of information, but as since their publication, the plant might have been displaced by crops, I have also had recourse to the assistance of botanists living in the departments situated on the northern frontiers of the zone occupied in France by *Coronilla scorpioides*, together with the study of a large number of samples of French seeds (clover and lucerne) which I have examined myself. Wherever I have applied for information, I have been met with the greatest kindness, and I am happy to express again here my sincere thanks to all those whose co-operation has enabled me to acquire a quantity of valuable information (7).

I summarise below the results obtained by adopting the following order: Starting from the extreme north-western limit of the zone of vegetation of the plant, I shall reach the East of France, to return again to my starting point, after having, as is about to be confirmed, entirely encircled the central block.

VENDÉE. — *Coronilla scorpioides* is met with solely in the southern plain. Localities where the plant is indicated: Bonet, Saint-Pierre-le-Vieux près Maillezais, Mouzoil près Nalliers, are, in a general way, nearly all situated in the region of Luçon and Fontenay-le-Comte. *Coronilla scorpioides*, moreover, is never very abundant there; the areas pointed out by LLOYD 60 years ago have not been extended. Besides, the plant is smaller and less vigorous than in the South.

DEUX-SÈVRES — LLOYD described this plant as being fairly common; BOREAU, in his Flore du Centre, mentions it at Thouar, Saint-Jouin, Airvault. The particulars I have gathered only report it at la Gâtine, where *C. scorpioides* has never been met with by my correspondent. Moreover, the seeds of the plant have not been found in the samples of clover or lucerne supplied by the farmers of the Department. It is true that the localities whence it has been sent to us are sufficiently removed from the areas indicated by BOREAU; they are, however, more southern, and situated quite at the south of the district of Parthenay, as well as in the neighbourhood of Niort and Saint-Maixent.

MAINE-ET-LOIRE. — *Coronilla scorpioides* is very rare in Anjou, and is only met with in a few calcareous areas in the district of

Saumur: Vihiers, Doué, Puy-Notre-Dame, Montreuil, Fontevrault (BOREAU, 1859), where, moreover, it only appears now and then. The same remark applies with regard to the samples of clover and lucerne. Only one locality from which these seeds reached us is situated in the district of Saumur, quite in the south.

VIENNE. — The various floras that I have consulted indicate that the plant is relatively common in crops and on calcareous waste land. The areas mentioned are the following: Loudun, Poitiers, Saint-Bénoît, Cissé, Auxances, Marmande, La Grande-Maison. The seeds have not been met with in the samples of seed of the two fodder-plants with which we are dealing; nevertheless, a good number of the localities whence they come are situated in the neighbourhood of the places where *C. scorpioides* is indicated.

CHARENTE. — The plant must be fairly common in the Department.

One of my correspondents points out that it would require searching for in the Confolontais towards Saint-Cloud and Chassensuil. On the other hand, the samples of clover coming from Vars, d'Anais, de Tusson, the Plans de Ruffec, contained some seeds of *C. scorpioides* amongst their natural impurities.

DORDOGNE. — The plant appears to be relatively fairly well diffused here; in any case, one of the samples of clover coming from Rouffignac, Canton of Sigoulès, district of Bergerac, included some seeds of *Coronilla scorpioides*. DESMOULINS, moreover, in his catalogue of plants of the Dordogne, points out that this *Coronilla* is common in fields and cultivated places: Bout des Vergnes près Bergerac; in the crops; Ribérac, in a field above the town and on a hill called Terrier de Lambrette near Saint-Aulaye sur Dronne (ABBÉ REVEL, 1885).

CORREZE. — The plant seems to be rather uncommon in this Department. It has been noted in the following stations, all situated between Brive and le Lot: Croix Lagarde, Commune of Noailles, Chasteaux, valley of Entrecor, Puy-de-Crochet. We have not received any samples of clover or lucerne from this Department.

LOT. — The local floras note the plant at Rocamadour, Roque de Cor, Saint-Georges, Les Cayssines près Cahors, Montrey, Lissac, Canton of Figeac. The very few samples supplied by this Department contained some seeds of *C. scorpioides*.

AVEYRON. — A. BRAS mentions vineyards and cultivated fields. The areas he indicates are the following: Arrondissement de Ro-

dez : Le Cruounet. Arrondissement de Villefranche : crops of the tableland of Ordiget, de la Bouisse, bois de la Gueste ; Salvagnac-Cajaro : crops of the tableland of Cubèle, Asprière, Naussac, Sonnac. One of the few samples of clover supplied by the farmers of this department contained some seeds of *C. scorpioides*. Other areas : Nant, Saint-Jean-du-Buel, Vabres, Saint-Izaire (ABBÉ COSTE), have been also mentioned.

CANTAL. — According to LAMOTTE and FRÈRE HERIBAUD, the areas of this plant, rare in the Cantal, are reduced to a few localities in the neighbourhood of the Departments of Lot and l'Aveyron : Monmurat, Gratacap, Saint-Santin-de-Maurs.

HÉRAULT. — The plant is noted as being very common in cultivated fields. As in the case of Cantal, no consignments of clover and lucerne have been made to us.

GARD. — DE POUSOLZ and LAMOTTE found this plant in the neighbourhood of Nîmes, at Vigan, Anduze, Alais, Saint-Ambroix.

On the other hand, one of the samples of lucerne from this Department, from Cornillon near Pont-Saint-Esprit, contained seeds of *C. scorpioides* amongst its impurities. The plant is known in this department, and has a local name.

ARDÈCHE. — The limits given by SAINT-LAGOR are the following : Le Pouzin, the valley of the Ouvèze, Celle, and near d'Aubenas, Vals and Mercuer. A sample of clover from the district of Chomérac contained some seeds of the plant. In 1897, CARIOT and SAINT-LAGOR mentioned the presence of the plant on the banks of the Rhône, in the valleys of the Ardèche, and the Ouvèze. Elsewhere, RÉVOL (1910) is more definite, and gives the following particulars : southern districts of the basins of the Ardèche up to Saint-Privat, Aubenas, Ucel, the tributaries of the Cèze, the valleys of la Couche, of the Escoutay and the Ouvèze low hills of Coiron up to 500 m. and the banks of the Rhône up to the Valley of Celles, Lavoulte, Chateaubourg.

DRÔME — SAINT-LAGOR points out that in the Drôme, *C. scorpiodes* grows near Nyons, Crest, Barnave and Valence ; other areas Saint-Nazaire (CARIOT and SAINT-LAGOR, 1897).

HAUTES-ALPES — Gap, Ribiers, Rosans are, still according to SAINT-LAGOR, the limits of locality of the area of extension of the plant in this Department. CARIOT and SAINT-LAGOR (1897) indicate still another district : Notre-Dame du Laus.

The few samples of clover and lucerne which have reached

us from Rosans, Lazer, contain numerous seeds of C. [illegible]

ISÈRE — SAINT-LAGER mentions here, as [illegible] Mens, Rochefort, the Balmes de Claix, [illegible], Saint-Martin-le-Linoux, areas which, moreover, are all grouped in the district of Grenoble, to the south of this town in the basin of the Drac, with the exception of Saint-Martin-le-Linoux, which is a little to the north of Grenoble, on the right bank of the Isère.

RHÔNE. — In the Rhône the plant is rare. Les Carpennes, Villeurbanne (CARIOT and SAINT-LAGER, 1897). According to my correspondent, it is never found ordinarily in clover and lucerne. In certain years, however, it has been noticed, but very likely this has been the result of an accidental introduction, due to the employment of seed coming from the south. In a general way, it rapidly tends to become rare and to disappear, except in the areas where the conditions are particularly favourable to its existence. The seeds of the plant have not been met with amongst the natural impurities of the clover and lucerne of this department.

AIN. — The plant is not mentioned in the Ain district. One of my correspondents, however, has come across it several times between Miribel and Montlöel, in fields of wheat, along a very much exposed river bank. The samples of clover from the Ain do not, up to the present, contain seeds of the plant. This Department has not supplied us with any lucerne.

SAÔNE-ET-LOIRE. — Found occasionally at Bourbon Lancy and at Marigny-sur-Loire. *Coronilla scorpioides* has not held its own in these districts. Besides, according to my correspondent, the plant has never been met with in the fields of lucerne and clover

LOIRE. — The plant is not found in this Department; at least the floras which I have consulted do not indicate it [illegible] Statistique botanique du Forez, 1873; CARIOT and SAINT-LAGER, *Flore descriptive du bassin moyen du Rhône et de la Loire*, 1897). On the other hand, none of the numerous samples of clover [illegible] ed contained seeds of this plant.

ALLIER. — *Coronilla scorpioides* has been previously noted at Pont de la Chambrière près Montluçon.

NIÈVRE. — The plant has not been noted in this Department. [illegible] points out

LOIRET. — Jullien CROSNIER, according to NOUEL, [illegible] that *C. scorpioides* has been met with at Baccon. It is probably a question of an accidental appearance. In any case, the numerous samples of clover and lucerne coming from this Department have

never, up to now, had seeds of this plant amongst their impurities.

Loir-et-Cher. — *Coronilla scorpioides* has not been reported in this department. Moreover, the seeds do not figure amongst the impurities of the clover and lucerne which come from this region.

Cher. — *C. scorpioides* is extremely rare here. It has been pointed out formerly by Boreau at Saint-Michel, Bourges, Etrechy (near Osmery) (A. Le Grand: Flore du Berry), Morthomiers, la Chapelle-Saint-Ursin. A. Le Grand, in his flora of Berry, and in the supplement to this flora, adds a few other localities. It appears that it was abundant about fifteen years ago between the Camp d'Avor and Farges-en-Septaine, and has been gathered at Bangy in a rocky field where clover and lucerne have never been sown. According to one of my correspondents, it must be remarked that, in a general way, the places where the plant has been observed are quite barren areas and noted in Berry for the numerous southern plants which are found there; it could not be found on soils where the cultivation of seeds leys is practised. A. Le Grand mentions it as being very rare (R.R.) in the crops. In short, the plant may exist in Berry, but only as a very rare botanical curiosity, and without any practical importance. I have never found these seeds in the samples of clover or lucerne which I have had to examine.

Indre-et-Loire. — *Coronilla scorpioides* has been reported at various points: Antogny, Ports, Marcilly, from l'Ile Bouchard to Richelieu, Chinon. All these areas are situated in the district of Chinon, and, with the exception of this locality, between the course of the Vienne and the Department of the same name.

I have now returned almost to my starting point, since I have already examined the distribution of *Coronilla scorpioides* in the Departments of la Vienne and of Maine-et-Loire. I have already described, round the central block, and following the distribution of the plant in as exact a manner as possible, a complete circle, on the inside of which it does not exist, or would have, at most, an ephemeral existence. An exception must be made, however, in favour of the Puy-de-Dôme, where there are the following areas: Saint-Amand-Tallende (frère Heribaud), Puy-de Barnère (Lamotte), Saint-Saturnin, Saint-Sandoux (frère Gennardien). The plant, however, is uncommon.

From the practical point of view, a few conclusions might be drawn from the preceding study. I think there is no occasion to

take into acount the northern portion of the circle extending from the south of the Isère to la Vendée; for, generally the plant does not exist there, except in very rare instances; also, where it is pointed out as being fairly common, it does not appear to be sufficiently so from the point of view which interests us, since up to the present I have never found its seeds in the samples of clover and lucerne which I have had to examine. It is the same for the Department of Puy-de-Dôme. An exception might perhaps be made for the Department of la Vendée. This exception, however, hardly appears to be justified, at the very least, as regards clover: none of the centres of production is situated in the zone where *C. scorpioides* can be found; the only locality of this district having responded to our appeal, namely, Chaume, commune of Sainte-Hermine, has supplied us with a sample of clover which was entirely without seeds of *C. scorpioides*. Finally, the rather stunted state of vegetation of the plant in this Department renders very uncertain the presence of its seeds amongst the natural impurities of clover and lucerne. It is also very unlikely in the Department of Indre-et-Loire to be found with these two leguminous fodder-plants. As regards la Vienne, where the plant is common or fairly common, I remember that none of the samples of clover and lucerne, even those coming from points bordering on the stations occupied by *Coronilla scorpioides*, had the seeds of this plant amongst their impurities.

The southern half of the circle surrounding the central block on the south, from la Charente to la Drôme, must, on the contrary, be considered, from the practical point of view, as the northern limit of the districts where clover and lucerne are almost certain to include the seeds of *Coronilla scorpioides* amongst the number of their impurities. Thus, amongst the Departments situated to the south of this zone, all those who responded to our appeal supplied samples which frequently, almost without exception contained the seeds of this coronilla.

One result of a different nature has been evolved from the examination of the regional limits of vegetation of *Coronilla scorpioides* in France. It is very certain that the absence of the plant from the central block (the stations of Puy-de-Dôme apart) is partly due to the fact that the meteorological conditions no longer respond to the needs of this plant; but there is another cause, perhaps more important still operating to determine in a very exact

manner the distribution limit of *Coronilla scorpioides*, a cause which stands in relation to the requirements of the plant, viz., the structure of the soil of France itself. If, after having indicated on a map as accurately as possible, the geographical position of the areas enumerated above, this map is superposed on a geological map traced

FIG. 289. — Area in France covered by *Coronilla scorpioides*: cross-hatching = common habitats of the plant.

to the same scale, it is immediately noticed that the very great majority of the localities where the plant has been noted, are placed on the fringe of the secondary strata which surround the central block. I have endeavoured to obtain more exactitude by examining the respective situation of each of the areas on detailed geological maps, and I have ascertained that it is in a great measure on the Jurassic portion of this fringet hat the greater part amongst them are placed by preference. This coincidence some-

times acquires a remarkable degree of precision. There are now the Cretaceous areas; these areas are much more rare on the outcrops of the other geological formation.

With these data, and as a practical conclusion of this work, I think that, as regards the production of clover and lucerne, we

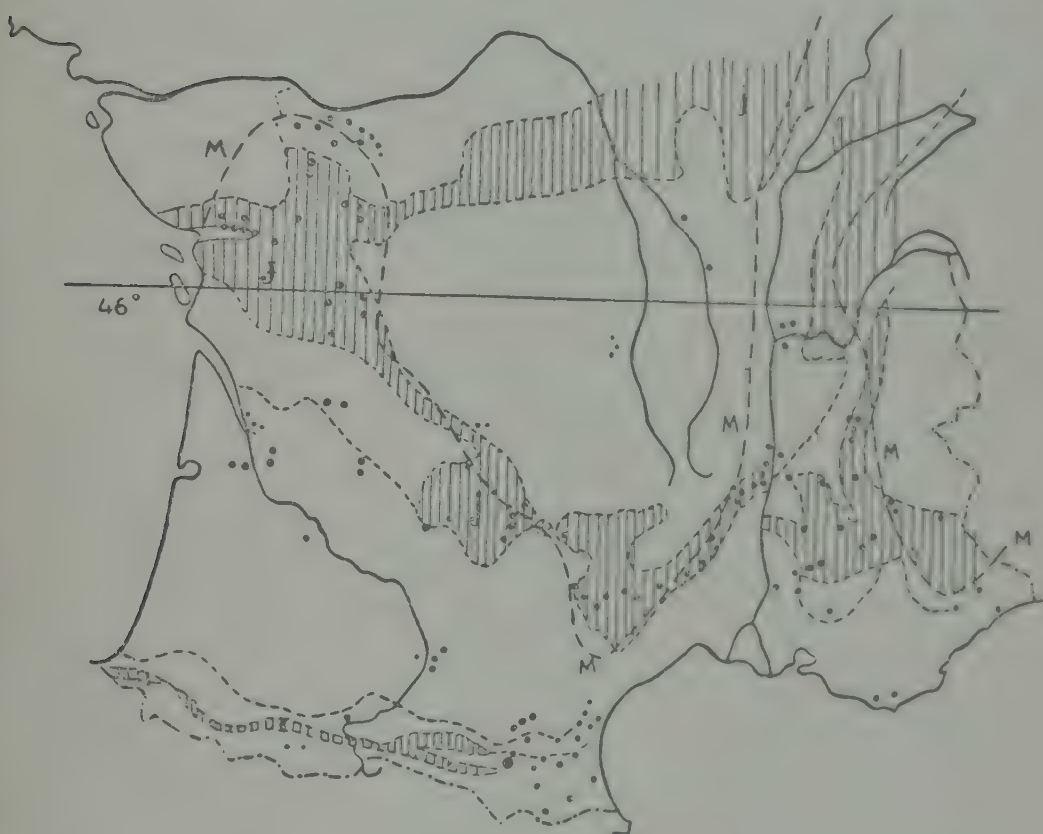

FIG. 290.

J. Jurassic.
M. Northern limit of maize growing.
Chief permanent habitats of *C. scorpioides*.
To the north of 46° and even south of that par[illegible] the appearance of *C. scorpioides* is always more or less transitory.

might consider as southern all the districts situated to the south of the Jurassic fringe, extending inclusively from la Charente to la Drôme, and leaving on the north of this limit le Rouergue and the Black Mountain.

I have indicated on the accompanying map the [illegible] of the limiting areas, and their correspondence with the [illegible] of the central block. Of course, on my rather small map, it is

impossible to respect strictly the intricacy of the geological deposits, and particularly their outcops on islets, often very narrow; nevertheless, it is sufficiently accurate I think, to enable one to determine very clearly the general bearing of the areas at the northern limits occupied, in France, by *Coronilla scorpioides*. I have also traced a portion of the limiting curve of the cultivation of maize, and it will be noticed that there is a certain coincidence between this portion of curve and the distribution of most of the areas mentioned above.

***

This study, undertaken with a practical object, concludes here. But I have thought that perhaps botanist readers would be interested to know, in detail, other French areas of *C. scorpioides*, and, first of all, those of the Departments situated on the other side of the Canal du Midi and the course of the Garonne.

These stations are distributed as follows: AUDE — (GAUTIERS: Flore des Corbières) Narbonne, Pech de l'Agnel, Montredon, Gruissant, district of la Chape, Sigean, Saint-Victor, tableland of Fontjoncouse, Durban, Albas, Villeneuve, Massac, Servières-en-Val, La Vène, Verzeille, Limoux, Alet, Quillan, Carcassonne, Bois de Serres, Charlemagne, Pont de l'Orbieu 500 m., Monthoumet 500 m. There again, in examining the geological map, it is seen that most of these areas are situated on calcareous lands, very frequently Jurassic, then Cretaceous.

EASTERN PYRENEES. — The local flora of G. GAUTIER gives the following districts: Charamany, Saint-Antoine de Galamus, Saint-Nazaire, Estagel, Rabouillet, Vallée de Tech, Albéres, de Céret to the Manère (973), Ria (near Prades).

ARIEGE. — An area indicated by MUTEL: Saleix 1013 m. near Vic Dessos, is distinctly situated on a Jurassic outcrop.

HAUTE-GARONNE. — Plant common in the neighborhood of Toulouse, everywhere on cultivated ground. PHILIPPE gives, in addition, two mountain areas: Saint-Béat 525 m.; Saint-Bertrand de Comminge 515 m., where the plant is common.

HAUTES-PYRENEES. — Common in the crops: valleys of Argelès, Barèges, Luz, are the districts mentioned by PHILIPPE, and by DULAC.

These areas enable the tracing of approximately the southern

limits of the zone occupied by *C. scorpioides* to the north of the Pyrenees. Between this limit and that which I have given previously — south and south-west border of the central block — extends the area occupied by the plant in the south-west of France.

Within these limits, *C. scorpioides* is commonly found in *Tarn-et-Garonne*, the *Lot-et-Garonne*, *Gers*, the *Dordogne* and the *Gironde*.

For this latter Department, CLAVAUD gives the following districts: Cultivated fields, crops on calcareous soil — Blaye — le Médoc (Chicou), Bourg, Cestats, Gradignan, Créon, Haux, Bayon, Le Rigalet, Poussignac in the Bazadais.

Let us now endeavour to trace the eastern limit of the area occupied by the plant in France. Here, parts of the following Departments: Alpes-Maritimes, Basses-Alpes, Hautes-Alpes, Drôme, Isère, will serve us. Most of them have already been indicated previously. I will add to them first a general note referring to the entire source of origin, and then particular indications for each Department.

PROVENCE. — The plant is found in the harvest fields, uncultivated places, all the coastal region (H. ROUX).

ALPES-MARITIMES. — Plant fairly common in stony fields (ARDOINE). Fairly common in the coastal region, and here and there in the mountainous region, where it grows up to 1,200 and 1,300 m. (BURNAT) — Antibes (THURET) — Gourdon (CONSOLAT) 760 m.

BASSES-ALPES. — Pointed out in the upper basin of the Ubaye, in the fields of the district of Barcelonnette 1,135 m. (LANNES).

These stations, joined to the localities indicated in the Hautes-Alpes, la Drôme and l'Isère, allow the tracing approximately of the eastern limit of the area of *C. scorpioides* in France.

In its southern part, this area adjoins the Ligurian coast and the neighbouring districts. On the other hand, in the basin of the Rhône, the limits running on both sides of the river, border a zone extending up to the level of Valence (and even a little more to the north on the Ardèche bank). Beyond there, *C. scorpioides* may still be met with occasionally, apparently more or less fugitive and never persists long.

The map given below shows the whole of the area occupied by the plant, and beyond which a few scattered spots indicate the localities, the points of territory, where it has been [illegible]

in a state of rarity, or as a botanical curiosity, and where, generally, it does not persist.

In order to be complete, I will indicate some localities situated in the Var, the Bouches-du-Rhône, and the Department of Vaucluse.

VAR. — Is met with in the coastal region: Toulon (HUET), Hyères (SHUTT).

BOUCHES-DU-RHÔNE. — In the fields it is sufficiently common not to merit any mention of locality.

VAUCLUSE. — Neighbourhood of the village of Vaucluse — Avignon and neighbourhood — district of Lubéron between Saignon and Cadenet — district of Carpentras, of Ventoux and the Monts de Vaucluse.

NEW INVESTIGATIONS MADE WITH A VIEW TO SPECIFYING THE CHARACTERISTICS OF CLOVER AND LUCERNE SEEDS OF THE SOUTH OF FRANCE.

This series of investigations was undertaken to ascertain whether the characteristics which we have made the basis for indicating the southern origin of clover and lucerne, were always valid, and also, if there be occasion, to add new characteristics to those which have been employed hitherto.

The certitude of the southern origin of a parcel of seeds of clover and lucerne is assured, at present, by the presence, in the lot to be examined, of seeds of the following adventitious plants: *Helminthia echioides*, *Centaurea solstitialis*, small *Rubus* achenes, *Torilis nodosa*, *Coronilla scorpioides*, to which must be added, but solely as a complementary characteristic, shell fragments, *Helix variabilis* particularly.

Helminthia echioides, which grows to a fair altitude in France, cannot be a good characteristic, if this impurity is alone, except on condition that its fruits are found in very great abundance in the parcel to be examined. The same may be said of *Centaurea solstitialis*, for the same reasons.

The presence of isolated *Rubus* stones is perhaps a better characteristic; but certainly that which is the most sure is the presence of seeds of *Coronilla scorpioides*. I have just been studying in detail the distribution of this plant in France, and remember that, from the discussion of the results obtained, we must consider

the seeds of this leguminous plant, even when isolated and in small quantity, as absolutely characteristic of the South.

These studies, made about ten years ago, were worth repeating, as are similar studies from time to time, as changes in the distribution of fodder crops may have brought about modifications in the area of extension of all these adventitious plants.

With this object, during the course of the months of July and August, I have studied the flora in the south-east of France, and more particularly in the departments of Vaucluse, the Bouches-du Rhône, Var, the Maritime Alps, the Basses Alpes and the Hautes-Alpes. The following are the results which I have obtained.

SAINT-REMY DE PROVENCE AND THE NEIGHBOURING DISTRICTS. — The adventitious flora of this district, so interesting from the crop point of view, so distinctly characteristic of the Provence, by its aspect and its horizons, includes amongst the most widely diffused species, the following plants: *Asteriscus spinosus, Helichrysum Stoechas, Centaurea paniculata, Trifolium stellatum, Trifolium angustifolium.*

These, in the clover fields, lucerne fields, waste lands and grass-covered uplands of the neighbourhood of the Alpilles. Then, in the plain covered with fodder and vegetable crops, irrigated for the most part: *Bonjeania recta, Centaurea solstitialis, Helminthia echioides*, these two latter species, very well diffused, particularly the second, which covers whole fields. *Coronilla scorpioides* is found here and there.

Finally, in a general way, the species which serve to characterise the southern origin of the lucernes and clovers are found here. It is the same with the presence of fragments of small shells (*Helix variabilis*) above all. These molluscs, in dry weather, take refuge on plants, even when dead and brittle, in masses which are sometimes so close, that they simulate clusters of fruit. The same phenomenon must take place at the time of the harvesting of plants, whence, as a result of the threshing, the presence in the seeds of fragments, sometimes very abundant, of the shells of these animals.

Definitively, the adventitious species characteristic of this region, in order of abundance, are: *Helminthia echioides, Centaurea solstitialis, Coronilla scorpioides*

To these must be added as complementary characteristics giving still further exactitude, in order of importance: *Trifolium*

augustifolium, *Trifolium stellatum*, *Bonjeania recta*, *Centaurea paniculata*.

Bonjeania recta is found in abundance on the border of the crops by, and in the neighbourhood of, the irrigation canals. These seeds, which resemble slightly those of fenugreek, are quite characteristic.

AVIGNON AND THE NEIGHBOURING DISTRICTS. — Cultivated fields between le Thor and l'Isle-sur-Sorgues. The adventitious species met with here are, in order of abundance: *Centaurea solstitialis*, *Helminthia echioides*, *Trifolium stellatum* and *Trifolium augustifolium*, *Centaurea maritima*.

The same general characteristics are evident as in the district of Saint-Rémy, but here there is extreme abundance of *Centaurea solstitialis*.

To the preceding plants can be added the following species: *Bromus madritensis*, *Bromus rubens*, *Hedypnois polymorpha*. The last is extremely abundant in dry places.

DISTRICT OF MARSEILLES AND NEIGHBOURING DISTRICTS — AIX. — In a general way, the adventitious vegetation of this district is analogous to that of the district of Saint-Rémy. Attention is drawn to the very great abundance of *Helminthia echioides* in lucerne and clover fields. This plant is also found in great abundance in grass-lands, and is even met with in the grass plots of Phare and the Parc du Prado.

The flora of the Basses-Alpes and the Hautes-Alpes, in the districts where clover and lucerne are cultivated, is analogous with that of the preceding Departments, in that the characteristic impurities are the same.

CONCLUSIONS. — The adventitious plants characteristic of the South are, in general, identical with those which have been pointed out formerly, and the conclusions drawn in 1914 are exactly the same to-day.

We will consider as being of southern origin the clovers and lucernes containing, say, all the four following species: 1. *Coronilla scorpioides*, 2. *Helminthia echioides*, 3. *Centaurea solstitialis*, 4. small stones of *Rubus* sp. or, in the absence of *Coronilla scorpioides*, species 2 and 3, on condition that we find considerable quantities of their fruits in the samples to be examined.

The following species: *Trifolium stellatum* and *Trifolium augustifolium*, *Bonjeania recta*, *Bromus rubens* and *Bromus madritensis*,

Hedypnois polymorpha, supply interesting information, but are not at all necessary to certify that a clover or a lucerne comes from the South, if, amongst its impurities, the sample contains some seeds of *Coronilla scorpioides*, or in its absence, considerable quantities of seeds of *Helminthia* and *Centaurea solstitialis*.

Complementary information which may be take into account, is given by the presence of *Rubus* stones and the remains of shells of *Helix variabilis*.

***

I will terminate this series of studies by the following memorandum, the result of investigations carried out during the summer and autumn of 1923.

ON THE PRESENCE OF *Trifolium supinum* SAVI, IN FRANCE.

HISTORIC. — There was repeatedly pointed out, during the course of the last century, the appearance in France of an Italian leguminous plant: *Trifolium supinum* Savi, of which the nearest areas to our country are southern and central Italy. But, the most recent general French floras, namely, Flore de ROUY, of l'Abbé COSTE and the flora in course of publication by Gaston BONNIER, make no mention of this plant. *Trifolium supinum*, therefore, does not exist officially in the floras of our country.

Let us now study the local floras: *Trifolium supinum* is mentioned for the first time, at least to my knowledge, in 1815 by A. P. DE DANDOLLE at Port Juvénal near Montpellier (1). Then at the same place by DELILLE (2) in 1826-29. Mentioned again in 1828 in the second edition of the *Botanicon Gallicum* in the neighbourhood of Nîmes and Montpellier (3).

In succession, A. MUTEL (1834) in his *Flore Française* (4) mentions the plant at Port Juvénal and at Nîmes. [illegible], DUNAL (1841), GRENIER and GODRON (1848) *Flore de France*, [illegible] (1854) *Flora Juvenalis*, TOUCKY ([illegible]) mention *Trifolium supinum* in the same locality (5-6-7-8-9-10).

In other districts, the history of the appearances of the plant is as follows:

GRENIER in 1857 ([illegible] *des environs de Marseille*) mentions the presence of the plant at [illegible]lans and Belle de Mai,

where it had been found by MM. BLAISE and ROUX (11-12). These last two mention it again in 1858 at Marseilles. These areas no longer exist to-day.

Later, in 1882, de FONTVERT and ACHINTRE, in their *Catalogue des Plantes vasculaires des environ d'Aix en Provence* (15) mention that they found *Trifolium supinum* at the edge of a field at la Pioline; mentioned again the following year by SAINT-LAGOR in his *Catalogue des plantes vasculaires de la vallée du Rhône* (16).

Outside the preceding districts, *Trifolium supinum* has been mentioned by DE MARTRIN-DONOS (14) in 1864, in the *Florule du Tarn*, in the neighbourhood of Castres, and has not been seen again since. The existence of this clover is found again, mentioned in the *Catalogue des plantes de Provence* (17) by SHUTTLEWORTH, HUET, JACQUIN and HENRY (1889) at Antibes (THURET), Toulon (AUZENDE), Marseilles (ROUX and BLAIZE), an indication which is probably no other than that given by these authors in 1858.

Later, BURNAT (18), in his *Flore des Alpes Maritimes* (1896), mentions that the *Trifolium supinum* of the THURET herbarium, gathered at Antibes, has been introduced, with other clovers, into the Department of Var.

Let us add, moreover, that the most recent work of ALBERT (19) *Catalogue des plantes du Var* (1908) neither mentions the plant at Toulon nor in any other locality in this department. Finally, M. A. RÉGNIER (20), in his *Flore phanérogamique des Bouches-du-Rhône* (1916), mentions solely the district of la Pioline, indicated above, a district which, moreover, has long ceased to exist.

On the other hand, M. LECOMTE, Professor at the Museum d'Histoire Naturelle, having placed at my disposal the herbarium of adventitious plants, I found there several samples of *Trifolium supinum*, gathered at the following stations: Port Juvénal, REQUIEN (1845); Port Juvénal, GODRON (1853); La Belle de Mai — in the crops — BLAIZE and ROUX (1856); Saint Tronc — in ruins — BLAIZE and ROUX (1857); Les Olives, — in a field — H. ROUX (1860), districts situated near Marseilles or even on the threshold of this city.

Thuret herbarium: Meadows sown with the sweepings of haylofts, coming from Grasse (May 1863).

Cheverny (Loir-et-Cher) (1871), along the walls of the park, indication drawn from the herbarium of M. FRANCHET (1884).

Finally, the most recent information comes from the district

of Marseilles, where a botanist, M. BLANC, has met with a clover on the thrashing floor of the "La Pauline" mill at La Valentine on the 11th June 1916, and has not seen it again since (9).

In short, the *Trifolium supinum* Savi, introduced from time to time with foreign wool or seeds, has only been met with casually, in a sporadic state, especially in Provence, and has never been seen again in the districts where it was reported, except when re-introducted.

NECESSITY OF AN ENQUIRY ON THE SPOT. — Such was the state of the question when the attention of the Station d'Essais de Semences was drawn to this plant by the following facts: A certain number of French merchants, having sent to Switzerland samples of purple clover seeds, found the authenticity of the origin of their seeds contested, owing to the presence, amongst the natural impurities of these seeds, of seeds of *Trifolium supinum*. Let us add that, on verification, the presence of *Trifolium supinum* in the suspected seeds was absolutely certain.

The following facts may now be mentioned: For some years past we have found coming into France enormous quantities of clover and lucerne seed of Italian origin.

To what requirements does this arrival in France of such quantities of seed correspond?

We find ourselves met with two alternatives: Either, these seeds, owing to the change of the moment (10) and to meet the demand, have been bought at a relatively low price, with the sole object of selling them again, pure or mixed with the seeds of our own country, as French seeds, at a much higher price; or, they have served to form clover fields or lucerne fields intended for the production of seed.

In this latter case, it could happen that seeds of *Trifolium supinum* might be found in the seeds harvested on our territory, and it might happen, as has already occurred, that this impurity would have spread, and persisted in some favourable spots. In this case, seeds really French might be wrongly considered to be Italian. The question being of great importance, it was fitting to collect all the information likely to throw light on it, and to begin by going to the place, particularly the south-west, to travel through the following Departments: Vaucluse, Bouches-du-Rhône, Var, Alpes Maritimes, Basses-Alpes and Hautes-Alpes, in order to seek the plant in the districts where is has formerly been men-

tioned; then, in a general way, in the existing crops of crimson clover.

This journey for study was undertaken at the beginning of July, and was prolonged into September. I will not dwell on the marches and counter-marches necessitated by plant-collecting made with a fixed object, and extended over five Departments, often under unpleasant conditions as regards temperature. The result alone is of importance.

In all the districts where the presence of *Trifolium supinum* had been indicated, I found it impossible to find the least trace of the plant.

Amongst all the plant collections made in the districts where clover and lucerne are cultivated, I never once found it.

Conclusions. — This annual plant may have appeared sometimes as a botanical rarity, but has never persisted, and in any case has never been sufficiently abundant to constitute by its seeds a natural impurity of cultivated French clovers.

The negative results of these researches have been confirmed by information which has been supplied to me by some regional botanists of the highest authority. All, including myself, are unanimous in considering *Trifolium supinum* to be a fugitive species, very rare, and the appearance of which can never constitute anything but an accidental occurrence.

We are therefore induced to say that a clover cultivated on our soil never contains seeds of *Trifolium supinum* amongst its natural impurities.

In order to be absolutely sure I asked the Directors of the Agricultural Administrations of the Departments which I visited, to have sent to me samples of authentic origin, from which we could ascertain whether, after all, there might not be found some isolated seeds of this plant. This was a supplementary precaution. I received a certain number of these samples, and in none of them have I found the presence of this impurity, nor of *Hedysarum coronarium*, the seeds of which are so abundant in Italian clovers.

Such are the examples which I have chosen. They enable us to see the great practical importance and magnitude which questions of origin sometimes assume, and also show the scientific interest which is attached to the solution of similar problems. Sys-

tematization, geology, and botanical geography play a most [illegible] portant part here, and are the surest guides to depend upon, with the certainty of reaching the object which it was proposed to attain.

LOUIS FRANÇOIS,
Doctor of Science, Chief of Laboratory [illegible]
Paris.

NOTES.

(1) The seeds of the 2nd and 3rd groups constitute a whole which is often designated by the term "foreign seeds", that is to say, not belonging to the species forming the lot to be examined.

(2) Such is the commercial denomination of this wheat, which, in reality, does not correspond to a single type, but is formed by a mixture of several [illegible]

(3) NATHANIEL, LORD BRITTON, Ph. D. and Hon. ADDISON BROWN [illegible] Flora of the Northern United States, Canada, and the British possessions [illegible] land to the parallel of the Southern Boundary of Virginia, and from the Atlantic [illegible] ward to the 102 meridian. Vol III, 1898 (Appendix).

(4) *Ibidem*, Vol. III, (1898).

(5) Including Algeria and Tunis.

(6) See also the classification of Messrs. DENAIFF and SIRODOT [illegible]

(7) Correspondents; MM. D'ALVERNY, CHARRIER, CHÂT[illegible], ABBÉ [illegible] DURNAND, FÉLIX, HANNEZO, ABBÉ HERVIER, ABBÉ HY. DE KERSER, LAURENT, LE GENDRE, DE LITARDIÈRE, M. MOREL, PASCAUD.

(8) The figures between (*) refer to the table annexed to [illegible]

(9) Correspondents: MM. ARBEST, BELLE, CABANES, Abbé [illegible], DAGAN, [illegible] MAS, DUFFOUR, GALINAT, GERMAN, JEAN, LEMÉE, MARTY.

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TRIFOLIUM SUPINUM.

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DATES AND LOCALITIES WHERE THE PLANT HAS BEEN FOUND
(In this case it is only a question of the particulars given in the Floras).

[illegible]

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INVESTIGATION IN REGARD TO WEED SEEDS FOUND AMONG THE SEEDS OF ARGENTINA, WITH REFERENCE TO THEIR ORIGIN AND DISTRIBUTION IN THE PRODUCING DISTRICTS OF ARGENTINA.

Owing to the numerous analyses carried out during a period of more than twenty years it was possible to determine the weed seeds which usually accompany our cultivated seeds such as lucerne, flax, wheat, barley, oats, rice, canary seed, grass seed, etc.

Lucerne takes the first place among these seeds on account of the variety of the weed seeds contained in it, of native as well as of foreign origin, depending upon the seasons and the countries from which the seeds are imported. Argentina can be divided into two large zones of these weed seeds, for instance, the irrigated and the unirrigated areas, with their various sub-zones or regions.

I. Zone of irrigated land.

1. The National Territory of " Chubut. "
2. The National Territory of " Rio Negro. "
3. The Province of " Mendoza " and the National Territory of Neuquen. "
4. The Province of " San Juan. "

The first three areas produce more seed than local consumption requires, the surplus being sent to Buenos Ayres where it is sold to districts not producing lucerne seed, and if free from *Cuscuta*, is exported to other countries. The fourth area only produces enough seed for its own requirements, with the exception of San Juan the seed of which is frequently sent to Rosarion de Santa Fé to be sold there for sowing in the Province of Santa Fé.

As all the seeds of these areas originate in irrigated districts it is easy to understand that many weed seeds are to be found among the seed coming from the South as well as among those from the North. Others indicate perfectly the region of origin and [illegible]. therefore, be considered as indicator-seeds for determination of the place of origin.

(1) Lucerne weed seeds from Chubut. The indicator-seeds of this region are marked with a*.

Anoda triangularis (Willd.)	(isolated seeds),
Brassica nigra Koch.*	(in moderate quantities)
Carex sororia, Kth.*	(» » »)
Cirsium lanceolatum Scop.	(» small »)
Cuscuta chilensis Ker.	(» » »)
(Probably imported from Chile)	
Grindelia brachystophana Grisb.	(isolated seeds).
Luzula patagonica Speg.*	(isolated seeds)
Melilotus parviflorus Desf.	(in moderate quantities)
Polygonus campestre Lmk.	(in small quantities)
» *chilense* Meisn.	(in large quantities)

(characteristic of Chubut when present in a very large quantity).

(2) Lucerne weed seeds from Rio Negro. The indicator-seeds of this region are marked with a*.

Cassia aphylla Grisb.*	(in small quantities)
Cuscuta chilensis Kor.	(» » »)
Cuscuta racemosa Mart.	(» » »)
Cirsium lanceolatum Scop.	(» » »)
Melilotus parviflorus Desf.	(» large »)
Polygonum campestre Lmk.	(» small »)
Polygonum chilense Moisn.	(» » »)
Rumex magellanicus Grisb.	(» » »)
Sphacele hastata Grisb.	(» » »)

*Suaeda divaricata** Moq. sometimes, then in large quantities.

(3) Lucerne weed seeds from Mendoza and Neuquen. The seeds from Neuquen have, so far, been fairly free of weeds.

Amaranthus clorostachys Willd.	(in small quantities)
Chenopodium hircinum Schrad.	(» » »)
Chenopodium murale L.	(» » »)

(These three seeds are also frequently to be found among the seeds of un-irrigated lands).

Cuscuta racemosa Mart.	
» *chilense* Ker.	(in large quantities)
Lactuca Scariola L.	(» small »)
Melilotus parviflorus Desf.	(» » »)
Nicandra physaloides Gärtn.*	(» large »)
Panicum colonum L.* very frequent	(» small »)
Polygonum chilense Meisn.	(» » »)
Rumex conglomeratus Murr.	(» » »)
» *magellanicus* Grisb.	(» » »)
» *pulcher* L.	(» » »)
Setaria imberbis Roem.	(» » »)
Setaria leiantha Hack*	(» » »)
Sphacola hastata Grisb.	(» moderate »)
	(» small »)

(4) L u c e r n e w e e d s e e d s f r o m S a n J u a n, p a r t o f S a n L o u i s, t h e N o r t h o f C o r b o d a, T a R i o j a, C a t a m a r c a, S a n t i a g o d e l E s t e r o, T u c u m a n, S a l t a, J u j u y. The indicator-seeds of the region are marked with a[a].

Anoda triangularia (Willd) DC	(in small quantities)
Bidens leucanthus Willd*	(» » »)
Bidens scabiosoides, N. et Arn.*	(» » »)
Chenopodium opulifolium Schrad.	(» » »)
Cuscuta chilensis Ker.	(» moderate »)
» *racemosa* Mart.	(» large »)
Lippia modiflora Rich.*	(» small »)
Melilotus parviflorus Desf.	(» large »)
Modiola lateritia (Hock.) Schm.*	(» small »)
Modiola malvifolia Grisb.*	(» » »)
Paspalum plicatulum Michx.*	(» » »)
Schkuhria Bonariensis L.*	(» » »)
Sida rhombifolia L.*	(» » »)
Sphacele hastata Grisb.	(» » »

II. Zone of unirrigated lands.

(1) The South of the Province of Buenos Ayres and the South of the General Pampas.

(2) The West of the Province of Buenos Ayres, the North of the Central Pampas and the South of the Province of Cordoba.

Lucerne seed from the unirrigated lands is generally preferred both for home sowing and export.

These two areas differ but little as regards the quantity of weed seeds, but the seed of the South is usually purer than that of the West. Moreover, the latter has a larger variety of weed seeds. Naturally many of these seeds are also to be found among the seeds from the irrigated lands, but then, as a rule, as isolated grains, whereas among the seeds of unirrigated lands they are generally present in large quantities. Others, on the contrary, show by their characteristics that the seed originates in unirrigated lands.

Weed seeds which are frequently present in larger quantities among lucerne seed of the Southern area, although they are also to be found among the seed of the Western area.

Atriplex pamparum Spg.	(in large quantities)
Centaurus solstitialis L.	(» » »)

(Imported from Italy, this plant has spread to such an extent that it has almost become a plague).

Cirsium lanceolatum Scop. often but	(in small quantities)
Fumaria capreolata L.	(» moderate »)
» *officinalis* L.	(» » » .)
Melilotus parviflorus Desf.	(» » »)
Polygonum chilense Meisn.	(» » »)
Rynchosia Senna Gil.	(isolated »)
» *texana* Grisb.	(» »)
Rumex magellanicus Grisb.	(in moderate quantities)
Setaria italica P. B.	(» » »)
Solanum maritimum Mey.	(» » »)
Cuscuta chilensis Ker.	(» small »)
» *racemosa* Mffrt.	(» » »)
» *Trifolii* Babingt.	(» » »)

Lucerne weed seeds from the West, from Buenos Ayres, the Northern and Central Pampas and the South of Cordoba. — (Pampas formation, continental climate). The indicator-seeds are marked with a *.

Amaranthus clorostachys Willd. (often in moderate, but sometimes (in large quantities)

Ambrosia tenuifolia Spr.* sometimes and then	(in large	quantities	
Anthemis Cotula L.	(» small	»	)
Ammi Visnaga (L.) Lmk.* often	(» moderate	»	)
Brassica campestris L.*	(» small	»	)
Bromus unioloides H.B.K.	(» »	»	)
Cenchrus tribuloides L.*	(» »	»	)
Centaurea melitensis L.	(» »	»	)
» *calcitropa* L.	(» »	»	)
» *solstitialis* L.	(» »	»	)
Chenopodium album L.	(» moderate	»	)
» *ambrisioides* L. very often	(» large	»	)
» *hircinum* Schrad.	(» »	»	)
» *murale* L.	(» »	»	)
Cuscuta racemosa Bart.	(» moderate	»	)
» *chilensis* Ker.	(» small	»	)
» *Trifolii* Babingt.	(» »	»	)
Cyperus paniceus Boek.	(» »	»	)
Digitaria sanguinalis Scop.	(» large	»	)
Eleusine indica L. var. *tristachya**)	(» small	»	)
Euxolus muricatus Gil.	(» »	»	)
Hordeum halophilum Grisb.	(» »	»	)
Lepidium pubescens Desv. often	(» moderate	»	)
Lythrum hyssopifolia L.*) sometimes	(» small	»	)
Melilotus parviflorus Desv. »	(» moderate	»	)
Onopordon arabicum L.*) »	(» small	»	)
Oryzopsis ovata (Tr. et Rup.) Speg.*)	(» »	»	)
Oryzopsis tuberculata (Desv.) Speg.*)	(» »	»	)
Panicum Bergi Arechev.*)	(» moderate	»	)
Paspalum vaginatum Swrtz.	(» small	»	)
Panicum capillare L.*)	(» »	»	)
Physalis viscosa L.	(» »	»	)
Phalaris intermedia Bose*)	(» moderate	»	)
Plantago patagonica Jack. var. *typica* Speg.*) indicator-seed of the Pampas often	(»	»	)
Polygonum convolvulus L. sometimes	(» »	»	)
Roubieva multiflora Moq.	(» »	»	)
Rumex conglomeratus Murr. often	(» »	»	)
Rumex crispus L. »	(» »	»	)
Rumex obtusifolius L.	(» »	»	)

Rumex magellanicus Grisb.	often	(in moderate quantities)
Rumex pulcher L.	»	(» » »)
Setaria imberbis Roem.	»	(» » »)
Sisymbrium columnae Jacq.		(» small »)
Stipa hyalina Nees ; *)		(» » »)
Stipa setigera Prsl. var. (*pusilla**)	often	(» moderate »)
Stipa tenuissima Tr.		(» » »)
Verbena gracilescens Cham*)		(» » »)

In addition, seeds imported for reproduction purposes :

Cichorium Intybus L.	sometimes	(in small quantities)
Cynodon Dactylon Pers.	»	(» » »)
Plantago lanceolata L.	»	(» » »)

Although these three plants have spread to such an extent that *Cynodon Dactylon* may already bec onsidered as a plague of the lucerne fields, their seeds are only found sometimes and in small quantities among the seeds of lucerne.

When the indicator-seeds above mentioned are present in large quantities it is a sure proof that they originate from unirrigated lands.

S u m m a r y : Lucerne seed froms irrigated lands, which comes on the market usually contains the following seeds in large quantities :

Melilotus parviflorus Desf., *Polygonum chilense* Meisn., *Rumex magellanicus* Grisb., *Suaeda divaricata* Hoq.

In small quantities : *Brassica nigra* Koch., *Carex sororia* Kth. *Cassia aphylla* Grisb., *Grindelia brachystephana* Grisb., *Panicum colonum* L., *Sphacele hastata* Grisb.

In addition, in many cases :

Cuscuta racemosa Mart., *Cuscuta chilensis* Ker.

Lucerne seeds from unirrigated areas usually contain the following seeds :

In large quantities : *Amaranthus clerostachys* Willd., *Chenopodium ambrosoiides* L., *Chenopodium hircinum* Schrad., *Chenopodium murale* L.

In smaller quantities : *Bromus unioloides* H. and K., *Centaurea melitensis* L., *Cirsium lanceolatum* Scop., *Fumaria capreolata* L., *Lepidium pubescens* Desv., *Lolium multiflorum* Link., *Melilotus parviflorus* Desf., *Panicum Bergi* Arech., *Setaria imberbis* Roem.

Sometimes, in addition : *Cuscuta chilensis* Ker., *Cuscuta racemosa* Mart., *Cuscuta Trifolii* Bab.

The table gives the mean values of the coefficients concerned, and information as to the quality of the lucerne seed grown in the different areas and the dissemination of the Casento. These statements represent the results of investigations extending over many years.

Weed seeds of flax.

Although flax is not so extensively cultivated as lucerne and is more limited to the Central Provinces, yet the weed seeds contained in it are somewhat of the same nature. In consequence it is not possible to determine by them the place of origin of the flax seed.

The flax weed seeds are as follows, the most frequent being marked with a + :

Agrostemma Githago L., *Amaranthus clorostachys* Willd., *Ammi Visnaga* (L.) Lmk., *Anthemis Cotula* L.*), *Argemone mexicana* L., *Avena fatua* L., *Bromus unioloides* H. and H., *Camelina dentata* Pers., *Chenopodium hircinum* Schrad., *Chenopodium murale* L., *Centaurea melitensis* L., *Convolvulus arvensis* L., *Datura Stramonium* L., *Echium violaceum* L., *Galphinia brasiliensis* Juss., *Lepidium pubescens* Desv., *Lithospermum arvense* L., *Lolium multiflorum* Lmk., *Lolium temulentum* L., *Melilotus parviflorus* Desf., *Panicum Bergi* Arech., *Phalaria canariensis* L., *Phalaris intermedia* Bosc.*, *Polygonum chilense* Meisn., *Polygonum Convolvulus* L.*, *Raphanus sativus* L., *Rapistrum rugosum* All., *Rumex* sp., *Setaria imberbis* Roem., *Silybum Marianum* Gaertn., *Vaccaria segetalis* (Nock) Garcke. *Avena sativa* L., *Brassica campestris* L., *Bromus unioloides* H. and K.

Weed seeds of wheat.

The place of origin of wheat is, like flax, not to be determined by the weed seeds, as these are more or less alike in all the wheat areas. At most it can be said that in the Central and Northern provinces *Lolium temulentum* L. and *Hordeum vulgare* L. are present in large quantities, whereas in the South, *Agrostemma Githago* L. predominates. The same can be said of the Province of Entre-Rios, in which the seed of the Eastern districts on the Rio Uruguay, show more *Agrostemma Githago* L., *Vaccaria segetalis* (Neck.) Garcke and also *Galphinia brasiliensis* Jass, whereas in those of the Western districts on the Rio Parani larger quantities of *Lolium temulentum* L., *Polygonum Convolvulus* L. and [illegible] Dess. are present.

The following are the weed seeds of wheat of which those present most frequently and in larger quantities are marked with a + : *Agrostemma Githago* L.*), *Avena fatua* L.*), *Avena hybrida*, Koch., *Avena sativa* L., *Calapina Corvini* Desv., *Cynara carduncculus* L., *Echium violaceum* L., *Calphinia brasiliensis* Juss., *Hordeum vulgare* L.*, *Lithospermum arvense* L., *Lolium temulentum* L.*, *Meilotus parviflorus* Desf., *Polygonum Convolvulus* L.*), *Raphanus sativus* L.*, *Rapistrum rugosum* All. (not often, but sometimes in large quantities), *Silybum Marianum* Gärtn., *Vaccaria segetalis* (Neck) Garcke, *Xanthium italicum* Moretti, *Xanthium spinosum* L.

In the case of other cereals such as barley oats and rye, similar weed seeds are found but less frequently and in smaller quantities. Oats usually contain much barley, wild-oats and sometimes seeds of *Caucalis daucoides* L. in moderate quantities. In addition *Polygonum Convolvulus* L. and *Lolium temulentum* L. are the weed seeds found most frequently.

Weed seeds of rice:

Much *Panicum Crus-galli* L. is found in the rice of the Cuyo Provinces (Mendoza, San Juan) ; the following seeds are found most frequently and in considerable quantities in the rice of the Northern Provinces (Tucuman, Salta, Jujuy) : *Modiola lateritia* (Heck) Schm., *Modiola malvifolia* Grisb., *Sida rhombifolia* L., in addition, *Digitaria sanguinalis* Scop., *Panicum insulare* L. Mey, *Paspalum plicatulum* Mohx., *Polygonum Persicaria* L. *Panicum Crus-galli* and *Polygonum persicaria* L. are probably reproductions of imported seeds.

Weed seeds of Canary Seed (*Phalaris canariensis* L.) : *Brassica campestris* L., *Lolium multiflorum* Lmk., *Lolium temulentum* L., *Polygonum Convolvulus* L., *Silene gallica* L.

Weed seeds of *Lolium Multiflorum* Lmk. and *Bromus unioloides* He. and K.

Of these two grasses, *Lolium* seed is more largely collected and is cultivated as a by-product, and as a cleaning crop for wheat and flax. Consequently, it often contains some of the same weeds as flax and on the other hand small grains of wheat. Of course such seeds as are noticeably different in form, size and weight from the seeds of *Lolium* are excepted.

Bromus is harvested in a clean condition and is cultivated also

as a cleaning crop for wheat and sometimes also of lucerne. It contains but few weeds, in place of which however small grains of wheat and isolated seeds of lucerne are to be found, mainly in the husks: *Medicago denticulata* Willd., *Medicago maculata* Willd., of which the first species predominates.

Brassica campestris L. is also grows as a cleaning crop of flax, hence contains some of the weeds of flax, especially sorrel seed (*Rumex* sp.) the separation of which is difficult.

This concludes the series of the more important agricultural seeds grown in Argentina, in regard to their specific weeds. The other crops such as, maize, cotton, etc., have either such large sized seeds that they do not contain weed seeds, or are grown to such a small extent, that they are not important.

WALTER VON PETERY,
Director of the Seed Laboratory of the Argentine Ministry of Agriculture, Buenos Aires.

Purity %	Inorganic admixture %	Useful weed-seeds %	Harmful weed-seeds %	Germinating energy %	Sprouted seeds %	Hard seeds %	Dead seeds %	Germinating capacity %	Practical value %	Weight per 100 gm. g.	Cuscuta seeds per kg
Province of Buenos Aires.											
94.35	4.03	0.21	0.41	66.07	71.30	21.00	7.70	81.80	77.50	1.910	442
56.53 % cuscuta free, 40.30 % with cuscuta, 3.17 % with cuscuta, within the limit of 10 grains per kg.											
Central Pampas.											
94.08	3.50	0.00	2.24	70.75	75.87	17.52	6.61	84.03	70.62	1.905	371
60.60 % cuscuta free, 34.05 % with cuscuta, 5.35 % with cuscuta, within the limit of 10 grains per kg.											
Province of Mendoza.											
94.02	4.23	0.00	0.76	54.05	59.90	36.58	3.52	78.19	74.22	2.010	408
29.06 % cuscuta free, 58.69 % with cuscuta, 12.25 % with cuscuta, but within the limit of 10 grains per kg.											
Northern Provinces, (San Juan, La Rioja etc.).											
94.87	4.97	0.02	0.14	47.50	54.78	40.18	5.04	74.87	71.03	2.036	2373
41.37 % cucusta free, 58.63 % with cuscuta.											
National territory "Rio Negro".											
94.43	2.74	0.02	0.70	57.63	64.81	32.72	2.47	81.17	78.20	2.010	4
79.40 % cuscuta free, 6.60 % with cuscuta, 14.00 % with cuscuta, but within the limit of 10 grains per kg.											

It is of course understood that these data possess only relative value, as giving approximately the characteristics of the seeds of the different regions. It is only by means of an investigation, if possible of a number of samples, representing as nearly as may be the total production, that it is possible to determine the exact coefficients of the seeds, beyond challenge.

Abstracts and Literature.

Uniformity in Seed Testing Reports.

ANDERSON, T. (Director, Seed Testing Station, Board of Agriculture, Scotland).)Paper read at the International Seed Testing Congress [illegible] (1).

A proposition is put forward to the effect that seed testing reports should be based on terms of percentage of pure germinating seed and percentage of impurities, and that the figures of germination should be suppressed.

The need for a uniform method of expressing results of analyses of seed samples is considered essential for international trade. This should enable the cultivator to ascertain the relative intrinsic value of the consignment of seed and should afford a fairer index of foreign ingredients.

The author discusses the advantages of such a procedure in detail. The proposed report would show the actual percentage weight, as nearly as can be calculated of the live seed, in contradistinction to the figure for germination which has a certain unreliability. This is considered in relation to the broken and damaged seeds usually excluded from the germination test, which would not affect uniformity of result if expressed in terms of pure germinating seed only, and if broken seeds and broken seedlings are classified together; estimation of small seeds and shrivelled or unripe seeds, empty glumes, dead seeds and shelled caryopses.

The issue of reports solely on germination or of only partial reports of purity or germination is depreciated.

The suggested form of report, is given as follows:

Pure germinating seed . . . . %
Hard seeds . . . . —
Broken seeds, broken seedlings . . . .
Empty glumes . . . .
Impurities (Foreign ingredients) . . . .

including:

Chaff, inert matter . . . .
Weed seeds . . . .
Useful seeds . . . .
Adapted for a purity separation only . . . .
Pure seed . . . .

excluding:—

Broken seed . . . .
Shrivelled seeds . . . .
Empty glumes . . . .
Impurities (foreign ingredients) . . . .

(1) Full report obtainable at His Majesty's Stationary Office, Adastral House, Kingsway, London W. C. 2. Price eleven shillings and six pence.

including :

Chaff, inert matter etc.	—
Weed seeds	—
Useful seeds	—

The Determination of Moisture in Seeds.

BUCHHOLZ, Y. (Director, Seed Control Institute, Christiania), Tables 2 (1).

The author draws attention to the exceptional difficulties attached to the determination of the moisture content of seeds. The results depend largely on the method of preparation of the sample (degree of grinding) ; the temperature and the duration of the drying process.

The results of several tests carried out at Christiania, are tabulated and the following method is proposed as useful in all cases of international transactions in seeds.

(*a*) *For cereals and other large seeds* (dry weight of 1000 grains more than 10 gm) 5 gm. roughly ground substance heated for 4 to 5 hours in a drying oven at 103°C.

(*b*) *For small seeds* (dry weight as above) 2 $^1/_2$ gm. whole seeds heated as before.

In both cases parallel determinations are important.

The importance of air tight receptacles for samples is emphasized.

In the discussion following this paper, VOIGT (Hamburg) stated that in Germany for certain seeds, a temperature of 98°C. was used and for others 103°C. The seeds were put in a cold oven and heated to the required temperature.

Should not reports on the purity of seeds indicate the percentage by weight of weed seeds and the names of those most plentiful in the samples analysed, and what species are to be described as weeds ?

BUSSARD, Léon, Assistant Director, Seed Testing Station, Paris (1).

In discussing the true interpretation of grade, and the confusion frequently caused amongst growers and seedsmen, it is considered advisable that Seed Testing Stations should adopt the simple formula :

$$\text{Grade} = \frac{\text{Purity} \times \text{germinating power}}{100}$$

The percentage of weed seeds can be determined by taking the total of all kinds when the percentage of each kind is less than 0.30 per cent. small seeds and 0.5 per cent. large seeds and in other cases by taking the separate percentage.

As regards the species to be considered as weeds, a questionnaire has

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resulted in listing the following species as the most abundant in North and Central Europe and these consequently should always be named in future reports.

Sinapis arvensis, *Chenopodium album*, *Plantago lanceolata*, *Rumex Acetosella*, *Daucus carota*, *Sheradia arvensis*, *Centaurea Cyanus*, *Stellaria media*, *Brunella vulgaris*, *Ranunculus* sp., *Vicia* sp., *Galiumj* sp.

Others less common, and limited only to certain areas but of undoubted importance, *e. g.* Dodder(*Cuscuta* sp.) should most decidedly be included in the reports of these districts.

The question of extraneous plants is discussed in relation to Seed Importation Acts and the advisability of stating with precision the proportion of extraneous seeds (useful or weeds) estimated as present in appreciable quantities in a sample of seed.

A suggestion was made in the discussion following the paper that each county submit to the International Seed Testing Association a list of the noxious weeds in which it is specially interested.

Report of the Dodder Committee.

DEGEN, A. VON. Director, Royal Hungarian Seed Control Station, Budapest

The report of investigations made by the dodder (*Cuscuta*) Committee appointed at the Copenhagen Congress with a view to the determination, at present only in Europe, of the bounds within which the dodder plant produces its noxious effects. A clear distinction is drawn between the large seeded dodder (*Cuscuta racemosa*) and that of the common dodder (*C. Trifolii*)..

The importance of climatic conditions in connection with dodder production is evident, and the consequent danger attached to imported seeds infected with dodder. Immunity to dodder infection appears to be confined to low altitudes, and in higher altitudes in northern regions of Europe the plants fail to become acclimatized and disappear after a short period. According to the reports received from Switzerland, only the *C. Trifolii* is found on the north side of the Alps and the effect is injurious only when the rainfall is limited to 1000 mm. In wet years the damage is negligible. *C. racemosa* is scarce and *C. arvensis* has not been reported.

As regards the boundary of dodder growth reported in other countries, the connection between growth and rainfall is not yet clearly defined, and further investigations are proposed on these lines.

The Work of the Official Seed Testing Station for England and Wales.

EASTHAM, A. Chief Officer, Official Seed Testing Station, Cambridge (1).

The work of the Official Seed Testing Station for England and Wales is discussed under four headings :—

(1) Testing for trade purposes ; (2) testing for samples taken from li-

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censed private Stations ; (3) testing for control samples taken by Inspectors in accordance with the regulations issued under the Seeds Act, 1920 (4) Investigation work.

Amongst other problems under investigation at the present time may be mentioned those concerned with : loss of vitality in seeds stored under varying conditions ; delayed germination with special reference to cereals ; hard seeds and the determination of their real value when present in leguminous seeds ; relation between germination of peas in the laboratory and in the field ; germination of sainfoin (*Onobrychis sativa*), with special reference to broken growths ; plumular growths in grasses.

The Vitality of Buried Seeds.

GOSS, L. (Seed Testing Laboratory, Bureau of Plant Industry, U. S. Depart. of Agriculture). *Journal of Agricultural Research*, Vol. XXIX, No 7, pp. 349-362, 2 figs. Washington, D. C., 1925.

The depth at which seeds are buried has little influence on the preservation of their vitality. Their power of germination, after burial, on the other hand varies according as it is a case of a cultivated plant or an indigenous weed. In the former case it is observed that the seeds, after being taken from the ground, no longer germinate whereas those of weeds survive for a longer period. Among the buried seeds of 107 species of the latter, 71 germinated after 1 year, 61 after 3, 68 after 6, 69 after 10, 50 after 16 and 51 after 20 years.

This investigation is of practical importance because it shows that the seeds of the majority of weeds do not perish when ploughed in, and that therefore the attempt to eliminate weeds in this way is useless ; this fact on the other hand, does not indicate that it is useless to bury weeds before they seed. The vitality of buried seeds ensures the covering of the country with vegetation. A. F.

Admixture of Annual Argentine Rye Grass Seed in English and Italian Rye Grass Seed.

ROGENHOFER, Dr. E. Italienisches Raygras und argentinischen Raygras *Oesterreichische landwirtschaftliche Marktzeitung*, No. 12, March 26, 1925, p. 2, Vienna.

When examining the seeds of Italian rye grass sent this year to the Confederacy's Institute for Plant-Culture and Seed-Selection (formerly Station for Seed Testing) in Vienna, for valuation, admixtures of 30 to 35 % of annual Argentine rye grass were found in several samples. The author describes the seeds of Argentine rye grass as very similar to those of English rye grass, from which they can only be distinguished when carefully examined. The Argentine seed is somewhat smaller and flatter. An awn is scarcely ever to be found on the outer glumes, as the glumes are always very badly damaged by the processes of thrashing and cleaning. It is by these thrashed-off awns and by the form and the colour that the small seeds of Argentine rye grass may be distinguished from those of the

English variety. In doubtful cases, the occurrence of weed seeds almost always furnishes a clue to the origin of the variety of rye grass in question.

On account of its short life and small yield of fodder, which is much inferior to the Italian variety, and which only gives one crop, the author advises that this seed should not be used and requests all purchasers of grass seeds not to buy them without a guarantee of purity, and to insist on a public statement to this effect.

H. K.

General Information.

Members of the International Seed Testing Association.

Honorary Members.

Prof. A. VOLKART, Zurick.
Sir Lawrence WEAVER, London.

Corresponding Members of the International Seed Testing Association.

Dr. Å. ÅKERMAN, Svalöf, Sweden.
Seed Commissioner G. H. CLARK, Ottawa, Canada.
State Agricultural Adviser A. ELOFSON, Upsaal, Sweden.
Professor NILSSON-EHLE, Åkarp, Sweden.
Professor W. JOAHNNSEN, Copenhagen, Denmark.
Professor E. LINDHARD, Lyngby, Denmark.
Dr. G. H. PETHYBRIDGE, London, England.
Professor R. G. STAPLEDON, Aberystwyth, North Wales.
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Seed Testing Stations.

Argentine.

Buenos Ayres: Laboratorio de Control y Análisis de Semillas, Calle Azopardo 900.

Austria.

Graz: Landwirtschaftlich-chemische Landes Versuchs- und Samenkontrollstation, Heinrichsstrasse 47.
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Calgary : Seed Laboratory, Immigration Bldg., Alberta.
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Bratislava : Štátne výskumné ústavy zemedelské, Ustav pro kontrolu semen, Matùskova 934.
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Kobenhavn : Statsfrokontrøllen, Fjords Alle 15.

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Giza : Seed Testing Station, Higher School of Agriculture.

Esthonia.

Tallinn (Reval) : Die estnische staatliche Samenkontrollstation, Kirikut, 4.

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Helsingfors : Valtion Siementarkastuslaitos, Punanotkonkatu 4.

France.

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Great Britain and Northern Ireland.

Belfast : Ireland : Seed Testing and Plant Disease Division, Queen's University.
Cambridge : Official Seed Testing Station, National Institute of Agricultural Botany, Huntingdon Road.
Midlothian, Scotland : Seed Testing and Registration Station, East Craigs, Corstorphine.

Holland.

Wageningen : Rijksproefstation voor Zaadcontrôle.

Hungary.

Budapest : Magy. Kir. Vetömagvizsgáló Állomás, II. Kis-Rókusutca 15.

Irish Free State.

Dublin (Ath Cliath) : Seed Testing Station (Department of Lands and Agriculture), College of Science, Upper Merrion Street.

Japan.

Kurashiki : Das Ohara Institut für landwirtschaftliche Forschungen. Provinz Okayama.

Latvia.

Riga : Versuchs- und Kontrollstation der Landwirtschaftlichen Fakultät und der Lettländischen Universität, Pflanzenbau Kabinett.

Norway.

Åas : Statens Frökontrollanstalt.
Bergen : Statens landbrukskjemiscke Kontrollstasjon og Frökontrollanstalt, Nygaardsgaten 50.
Trondhjem : Statens landbrukskjemiske Kontrollstasjon og Frökontrollanstalt.

Poland.

Kraków : Zaklad rolniczy doświadczalny Uniwersytetu Jagiellónksiego, Lobzowska 24.
Lwow : Panstwowa Stacja botaniczno-rolnicza, Zyblikiewicza 40.
Poznan : Stacja doświadczalna Wielkopolskiej Izby Rolniczej, Dabrowskiego 17.
Torun : Stacja oceny nasion Pomorskiej, Izby Rolniczej, Szopena 22.
Warszawa : Stacja kontroli nasion, Krakowkie Przedmiescie 66.

Russia.

Leningrade : Station d'Essais de Semences, Jardin Botanique.
Moscou : Station de Contrôle des Semences de la Société d'Agriculture, Smolensky Boulevard 8.

Sweden.

Borås : Frökontrollanstalten.
Gävle : Frökontrollanstalten.
Halmstad : Frökontrollanstalten.
Härnösand : Frökontrollanstalten.
Jönköping : Frökontrollanstalten.
Kalmar : Frökontrollanstalten.
Linköping : Frökontrollanstalten.
Luleå : Frökontrollanstalten.

Lund : Frökontrollanstalten.
Molkom : Frökontrollanstalten.
Skara : Frökontrollanstalten.
Stocksund : Statens centrala Frökontrollanstalten.
Täng : Frökontrollanstalten.
Västerås : Frökontrollanstalten.
Urebro : Frökontrollanstalten.

Switzerland.

Lausanne : Station fédérale d'essais de semences, Mont Calme.
Oerlikon-Zürich : Schweizerische landwirtschaftliche Versuchsanstalt.

United States of North America.

Arizona : Seed Laboratory, Experiment Station, Tucson.
California : Seed Laboratory, State Department of Agriculture, Sacramento.
Colorado : Colorado Seed Laboratory, Colorado Agricultural Experiment Station, Fort Collins.
Connecticut : Seed Laboratory, Experiment Station, New Haven.
Delaware : Seed Laboratory, State Board of Agriculture, Dover.
Idaho : Seed Laboratory, State Capital, Boise.
Illinois : State of Illinois Department of Agriculture, Division of Seed Inspection, Springfield.
Indiana : Seed Laboratory, Experiment Station, Lafayette.
Iowa : Seed Laboratory, Iowa State College, Agricultural Experiment Station, Ames.
Kansas : Seed Laboratory, Experiment Station, Manhattan.
Kentucky : Kentucky Agricultural Experiment Station, University of Kentucky, Lexington.
Maine : Seed Laboratory, Experiment Station, Orono.
Maryland : Seed Laboratory, Experiment Station, College Park.
Massachusetts : Seed Laboratory, Experiment Station, Amherst.
Michigan : The Seed Laboratory of the State Department of Agriculture, Lansing.
Minnesota : Seed Laboratory, University Farm Experiment Station, St. Paul.
Missouri : Seed Laboratory, Experiment Station, Columbia.
Montana : Seed Laboratory, Experiment Station, Bozeman.
Nebraska : Seed Laboratory, Department of Agriculture, Lincoln.
New Hampshire : Seed Laboratory, Experiment Station, Durham.
New Jersey : State Seed Laboratory, New Jersey Agricultural Experiment Station, New Brunswick N. J.
New Mexico : Seed Laboratory, Experiment Station, State College.
New York : Seed Laboratory, New York Agricultural Experiment Station, Geneva N. Y.
North Carolina : Seed Laboratory, Department of Agriculture, Raleigh.
North Dakota : Seed Laboratory, Experiment Station, Agricultural College.
Ohio : Seed Laboratory, Department of Agriculture, Columbus.
Oklahoma : Seed Laboratory, Board of Agriculture, Oklahoma City.
Oregon : Seed Laboratory, Experiment Station, Corvallis.

Pennsylvania: Seed Laboratory, Department of Agriculture, Harrisburg.
South Dakota: Seed Laboratory, Experiment Station, Brookings.
Tennessee: Seed Laboratory, Board of Agriculture, Nashville.
Texas: Seed Laboratory, State Board of Agriculture, Austin.
Utah: Seed Laboratory, State Crops and Pests Commission, Salt Lake City.
Vermont: Seed Laboratory, Experiment Station, Burlington.
Virginia: Seed Laboratory, Department of Agriculture, Richmond.
Washington: Seed Laboratory, Department of Agriculture, Olympia.
Washington D. C.: United States Department of Agriculture, Bureau of Plant Industry.
West Virginia: Seed Laboratory, Experiment Station, Department of Agriculture, Charleston.
Wisconsin: Department of Agriculture, Division of Seed and Weed Control, Madison.
Wyoming: Seed Laboratory, Experiment Station, Laramie.

The names of the countries are all stated in English and in the corresponding alphabetic order, whereas the names of cities and stations are as far as possible quoted in the original language, otherwise in the language used by the stations concerned in the correspondance with the Association.

Several countries, for instance Germany and Italy, are not placed in the list, as they have not yet joined the Association.

SPECIAL ACTIVITIES
OF THE BUREAU OF AGRICULTURAL SCIENCE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

ENQUIRY ON LOCUST CONTROL.

LOCUSTS IN 'IRAQ.

I.

GENERAL CONSIDERATIONS.

A good deal of information has been collected from time to time regarding the locusts of Upper'Iraq.

I cannot hope to add very much new information to that already existing, as all visits to Mosul by agricultural officials, including myself, have been paid at the same period of each year. Consequently, the study of locusts and their habits has been largely confined to the hatching and moulting period.

In 1923 I was enabled to get a better idea of the locust question for two reasons: (*a*) I had previous experience which made many aspects of the situation familiar to me; (*b*) my period of special duty at Mosul was a good deal longer than on the former two occasions.

THE LOCUSTS.

The annual outbreak of locusts during the early part of each year has been one of the chief obstacles to progress in the development of agriculture in Upper'Iraq.

I was deputed to investigate some means of control more economical and effective than those which have been hitherto employed.

The locust breeds over a very large area ; 3000 square miles would be a minimum estimate of the area in which it can be found.

Climatic conditions vary considerably between the extreme northerly and southerley points in which the locusts breed. This results in a good deal of difference between the dates of hatching of swarms, according as they are scattered over the country.

Locusts hatched south of Shergat are often flying while those north of Mosul are still in the moulting stages.

The locusts of Upper 'Iraq are indigenous. A migratory locust however visits this part of the country, coming from Nejd at intervals of from five to seven years. The locusts are yellow in colour, harmless to crops, and are very much liked by Arabs as an article of diet. Their local name is Nejdi.

Natural Enemies of Locusts.

The locust of Upper Iraq is fortunate in possessing few natural enemies, of which there are two only. One is encountered during the moulting stages and the other during the incubation period.

Sparrows, and a bird known locally as the Abu Sowaida, eat great numbers of locusts while they are passing through the moulting stages. Unfortunately for the agriculturist these are not in sufficient numbers to reduce the swarms to the extent required in order to ensure the immunity of crops from their ravages.

The other enemy, encountered during the incubation period, is cold weather. Thousand of eggs rot from this cause alone annually.

Bustards feed on the locust during the incubation period, but are in such small numbers that few locusts are destroyed by this means.

Egg Collection as a Method of Control.

A year would not be too long a time in which to investigate the possibilities of controlling the increase of locusts by this method.

The observations recorded under this heading are the results of a very brief enquiry.

Egg collecting is without doubt as efficient a method of control as can be employed at present, but it has disadvantages.

In Upper 'Iraq it is not possible to control more than the populated and incidentally the cultivated areas by this method.

Locusts prefer to deposit eggs in stony and undulating country, and favour barren land rather than areas covered with vegetation. On land of this nature it is their custom to breed thickly in very localised patches, but it constitutes no exception to the rule however, if they breed on land which is not of the above description.

Boys of twelve years of age can collect 2 ½ pounds of eggs each in three hours. To make the work attractive it would be necessary to pay six annas per 2 ½ pounds collected, and they would thus earn on an average one rupee per day.

I consider that money allotted for locust work should be spent on the collection of eggs, as I am certain that a better result is obtained by this method than by any other.

To work effectively a whole time organisation is required, which would endeavour to obtain a definite weight of eggs, gratis, according to the status of the Shaikh's concerned, before paying for quantities subsequently obtained.

Ploughing as a Method of Control.

To plough a breeding ground only is rarely sufficient to destroy the eggs turned up to the surface, and only when extremely cold weather is experienced afterwards is any appreciable result obtained.

Eggs can be collected from land after ploughing much more quickly and efficiently than by merely digging for them with a " fas ",

The type of plough and class of animal used locally at present,. are suitable to plough the land on which the majority of locusts deposit their eggs.

A good deal of land was ploughed after January this year (1923) in various districts, but where the eggs were not collected afterwards, hatching was as numerous as on land which was not touched.

Operations under this heading can of course only be employed in the vicinity of cultivated areas.

The locust which hatches far into the Jasirah will remain a difficult problem for many years, unless it can be attracted to breed nearer the populated districts. From my observations this year I am inclined to think this can be done to a very great extent.

Where it is possible to reduce the areas of the breeding grounds the control problem will be very much simpler.

Last year an extensive desert fire burned every scrap of vegetation on the plain between Makhmor and the Lesser-Zab.

This year quite 50 % of the locusts in existence hatched on this area, apparently for no other reason than that the land was clear of vegetation before they commenced laying eggs.

It might be well worth while therefore, to watch the area between Shergat and Ain Dibs next year and see whether quantities of locusts breed there, as this area has been completely burnt up.

An interesting feature observed this year was that several large swarms having escaped the fire, yet seemed to thrive in the neighbourhood of small Wadis, where they apparently subsisted on nothing but water for the last seven days of the hopper stage. Thus I think that their direction is always towards the river during the moulting stages, not, as is often supposed, because better herbage is obtainable, but because they require water.

The greatest difficulty and one that will always be experienced in operations against locusts, is to get local inhabitants interested in taking any steps whatsoever, unless their particular crops are threatened. This is particularly the case on the Right Bank, where people seem to regard any measures attempted against locusts as madness, providing that some chance remains in favour of their crops.

Looking at the case from their point of view, one sees that they are to a certain extent justified in showing a lack of interest in the problem (*a*) because there is always a chance that they will not suffer on account of locusts ; (*b*) if they do, prices of grain are so low that the question of providing grain for household purposes does not present many difficulties.

Many cultivators this year could not decide whether the cost of getting the grain in would leave any margin at all when the produce was marketed.

Conclusion.

I think it fairly safe to assume that all past efforts to control the pest, both before and since the occupation, can have had very little effect on the ultimate control of the locust.

Personally I believe that locusts will not increase in the absence of control measures, although more may appear in some years than in others.

Any form of direct attack upon hoppers should, I think, be discontinued as being both uneconomical and inefficient. At the present moment I do not think Government is justified in embark-

ing upon any scheme whatsoever, my reason being (*a*) that the cost of eradicating the locust of Upper 'Iraq would certainly incur too large a sum. (Always supposing one had sufficient inhabitants on which to spend the money). (*b*) The damage caused by locusts would represent but an infinitesimal portion of the sum required for their extermination.

II.

REPORT OF ANTI-LOCUST WORK DURING 1923.

I was deputed to go to Mosul on January 21, 1923, with the object of establishing a scheme for controlling the increase of locusts in the Mosul area.

Any schemes in the nature of former efforts to control locusts were decided to be economically impossible at the present time. The primary object therefore was to investigate the possibilities of new methods.

My first impression on arriving in the Mosul Liwa was the backward nature of winter crops. Thus I judged that if locusts appeared in ordinary numbers at their usual time depredations caused by them amongst crops were likely to be much heavier than usual.

Very heavy weather prevailed at the time of my arrival and one could seldom leave the beaten track until the end of February.

I wanted particularly to collect information regarding egg collecting, but by this time only a few days remained until the first hatching took place. It was therefore impossible to get sufficient data to be able to decide whether or not the adoption of this method would be justified.

A fairly comprehensive survey of the areas favoured by locusts as breeding grounds during the early part of March indicated that locusts were likely to be numerically superior to average years.

As the crops were so backward, it was therefore more necessary to get some scheme of control inaugurated to control the pest this year. The protection of standing crops only was especially important and I prefer to judge results obtained by that standard only. As far as the control of the pest is concerned, I consider results were of no value whatever.

The only possible means of control on the spot was the oil at Qaiyarah, but as no funds had been sanctioned I could do nothing

The divisional authorities expressed their surprise that I had no funds. The Mutasarrif was particularly anxious to get some scheme in force and representations made by him succeeded in a sum of Rs. 6000 being sanctioned to be spent on control measurse this year.

The divisional authorities at Mosul were anxious to distribute efforts over as wide an area as possible. The programme accordingly arranged was to engage five local Momurs for the month of April.

These were posted, one to each of the following districts : Tel-Afar, Tel Kaif, Mosul, Kara-Kosh, Shergat.

Shergat being the largest and most difficult district to control I remained in this area to conduct operations personally as far as possible. I was also able to arrange the supply of oil to other districts by being always within easy reach of Quiyarash.

Operations in each District.

Burning of swarms was commenced at Shergat on a large swarm situated close to the outskirts of cultivation on the Hawi Shergat. This swarm was completely destroyed and operations were then begun on the left bank of the river.

The extent to which this area was infested far exceeds anything previously met with by me. Operations were very successful however in keeping hoppers out of the crops until April 22nd.

After this date it became impossible to keep them out for two reasons, (*a*) because additional supplies of oil were needed and I had no more funds, (*b*) local cultivators ceased to give any further enthusiastic help, on the plea that they did not mind turning out for five days, but having worked fourteen with no apparent decrease on the advancing swarms, and crops showing no tendency to ripen, they concluded that it was no use continuing their efforts to save the crops. The subsequent damage to crops was extremely heavy, 15 to 20 acres of wheat and barley being eaten daily.

It being impossible to do anything further in this locality I commenced working on swarms in the Shura District.

The swarms here were comparatively small and manageable; at the end of April no crops had been attacked in this district.

Kara Kosh. — Hoppers in this area were very numerous despite the fact that 1600 pounds of eggs had been collected and destroyed during February. Swarms were fairly concentrated around the village of Tawalna. These were burnt as they appeared.

I toured the district thoroughly on May 9th and 10th and found no locusts, nor had damage been done. The praise for this is entirely due to the efforts of the Mudir of Kara Kosh.

Tel Kaif. — Burning the swarms commenced on April 10th and by May 9th 80 % of the swarms had been killed.

Very little damage had been done and the help given by Government was much appreciated by the Christian community of this district.

Mosul. — Crops around Hammam Ali suffered very heavily. Locusts having bred in crops were a very difficulty proposition in this district, as to destroy the locusts meant destroying the crops.

The Momur in charge of this area remained north of Mosul for the whole month. He suceeded in keeping hoppers out of crops only in the very limited area in which he worked.

Tel Afar. — By reason of the inaccessibility of this district it was not possible to carry out a very extensive programme of work.

Only one consignment of oil was sent to Tel Afar as the cost of transport of one gallon of oil from Quiyarah was more that the cost price of the oil. Thus repeated appeal from the Quaimmocam for more oil had to be disregarded. Moreover, conditions are very similar to those of Shergat.

The population is scarce and very widely distributed and the locust breeds over large and inaccessible areas.

At the time I left Mosul, Rs. 3700 had been spent, of which Rs. 2320 had been spent on oil. The remainder was spent on transport and other small incidental expenses.

Conclusion.

This year's campaign has been sufficient to convince me of two things : (*a*) that direct attack on the locust cannot be made on a sufficiently large scale at the present moment to have any appreciable effect, because any amount of funds cannot make up for the small population ; (*b*) that no more money should be spent on locusts unless a proper organisation is formed which would be in existence permanently.

However small such organisation might be, it would do infinitely more good than is possible by one individual who goes to Mosul for a short period each year.

It is possible to save a good deal of the crops each year by fighting

locusts in the hopper stages. It is doubtful however whether the amount of good done justifies the cost of carrying out these operations.

In dealing with the pest it is the extermination of locusts that should be aimed at, crops will then be saved as a natural corollary.

There is a tendency in Mosul to think that as long as Government spends money annually on locusts some good is being done. The question is debatable. I maintain that we have by our previous activities strengthened local opinion that danger only exists when locusts commence hatching.

Actually, danger is ever present, either in latent or active form and the only way of overcoming the apathetic interest shown by local villagers at present, is to continually instil this fact into them.

Thus if one was sufficiently optimistic one could foresee the day when the villagers would turn out and collect eggs during the winter months, with the same enthusiasm that they show when a huge swarm of locusts is within a few yards of their finest crop.

It seems fairly safe to assume that all past efforts have had no effect whatever on the ultimate control of the pest. Therefore, unless a comprehensive scheme, continued ever a number of years, can be sanctioned, I consider that in the best interests of all concerned the problem should be left entirely alone.

E. A. KINCH,
Agricultural Department, Baghdad, 'Irâq.

International Organisation for Locust Control.

In accordance with the resolution in Art. 3 of the Convention with regard to international organisation for locust control, passed in Rome, 31st October 1920, at the International Institute of Agriculture, a special agreement has been made with the countries of North-Equatorial Africa, with the same end in view and on the same date.

Referring to this Agreement the "Service de défense des cultures d'Algérie", charged with collating investigations carried out in Morocco, Algeria, Tunis, Tripoli, Egypt, and French West Africa, [illegible] by month, a map of the flights of locusts, of which it [illegible] copies to the countries interested and also to the International [illegible] of Agriculture, which uses them for its own special [illegible]

AGRICULTURAL INTELLIGENCE

AGRONOMY.

Soil Science.

See R. Part II. *Proceedings of the International Society of Soil Science*, Abstracts.

Fertilisers and Manures.

807. **Availability of Nitrogen in Organic Manures.**

ADINARAYANA, Rao K. *Journal of Madras Sdutents' Union*, Vol. XII, No. 12, pp. 443 446, tables 4. Coimbatore, 1924.

In order to ascertain the availability of nitrogenous plant food material in manurial substances used by the Indian cultivator, the author carried out experiments on oil cakes and green manures, the amounts of available ammonia, nitrates, and nitrites being estimated at the end of 4 weeks and 8 weeks, and comparison made with the controls.

The conclusions drawn were as follows:

Green Manures. The nitrogen derived from *Cassia auriculata* is not of immediate use to the crops, only 3.33 % of the nitrogen being available as nitrate after 8 weeks.

Pongamia glabra gave 14 % as nitrates, and *Calotropis gigantea* 28 % in the same period.

Oil Cakes. White Castor Cake gave 80 % of its nitrogen in the form of nitrates, Black Castor Cake 57 %, Neen Cake 57 %, and Pugnan Cake 50 %. Illupai Cake resisted all bacterial action during the eight weeks, probably owing to the presence of a poisonous glucoside. W. S. G.

808. **Preparation of Phosphoric Acid: Replacement of Sand by Potash Silicates in the Volatilization Process.**

ROSS, W. H., MEHRING, H. L. and JONES, R. M. (Bureau of Schools, Washington, D. C.). *Industrial and Engineering Chemistry*, Vol. 16, No. 6, pp. 563-566, June 1924.

The authors partly summarise preceding articles (1) relating to the industrial preparation of phosphoric acid by the volatilization process,

(1) ROSS, CARRUTHERS and MERZ, *Ind. Eng. Chemistry*		9, 26. 1917.
CARUTHERS and MERZ	» » »	10. 35. 1918.
ROSS and CARRUTHERS	» » »	5. 725. 1913.
ROSS, *Inter. Cong. Applied Chem.*		15. 217. 1912.

and make an interesting comparison between the experimental results obtained by this process, and the data theoretically obtained by an application of NERNST's theory to the calculation of the temperature for the decomposition of calcium phosphate.

It was found by experiment that if chemically pure tricalcium phosphate was heated to 1300°C., with or without the addition of silica, very little loss of phosphorus occurred either in an oxidising atmosphere or in one deprived of oxygen. When on the other hand the phosphate is mixed with [illegible] of its weight of carbon in a reducing atmosphere at 1300°C., about 45 % of the phosphorus present in the mass is volatilized, at 1400°C. 90 %, and at 1550°C. decomposition may be said to be complete. By adding both sand and carbon to the phosphate a still more marked effect was obtained in the process of volatilization of the phosphorus. When the carbon silica-phosphate-carbon mixture contains three molecular equivalents of calcium to one of silica, at *1300°C*, 97 % of the phosphorus is volatilized. If the molecular equivalent of silica be increased up to one of calcium to one of silica, the percentage of volatilized phosphorus decreases.

From the theoretically calculated data, based on the various possible decomposition reactions of the phosphate, it is shown that *silicic acid cannot replace in any considerable quantity phosphoric acid at a lower temperature than 2300°C.*; that the phosphate, in the presence of silica and carbon, may be decomposed at between 1100 and 1300°C. and in the presence of carbon alone may be decomposed only at from 1300 and 1400°C.

From this comparison between the theoretic and experimental data which, as is seen, are entirely in agreement, the authors deduce that the volatilization of phosphorus by the carbon-silica-phosphates-calcium mixture, at a temperature below 1300°C. is not due to the replacement of the phosphoric acid by a very small quantity of volatile silicic acid, but to a reaction, in the presence of silica, in which carbon takes part.

Now since the volatilization of phosphorus under these conditions does not depend directly on the acidity of the charge, the use of a potash silicate seemed possible. By replacing the silica in the charge with a potash silicate, the authors proposed, with a single operation, to volatilize the phosphorus and potash. This very interesting problem was thoroughly studied by the authors, who, in this note, give the data of numerous practical experiments made. When in the ordinary charge the silica is replaced by an equivalent quantity of potash shale, so that for a molecular equivalent of silica there are three equivalents of calcium, the authors observed that both the volatilization of the potash and that of the phosphorus begins at 1050°C and that at 1300°C more than 90 % of both are volatilized. Below 1300°C either the mass does not melt at all or merely a beginning of fusion is observed, when the charge contains less than 20 % of sand or shale and more than 25 % of carbon. By oxidation, in the presence of water, of the volatilized product a solution of potassium phosphate in [illegible] may be obtained.

L. M.

[808]

809. **Determination of Phosphoric Acid in Fertilisers.**

BRECKENRIDGE, J. E. *Industrial and Engineering Chemistry*, Vol. 16, No. 11, p. 1180, November 1924.

The volumetric method for determining phosphoric acid, which has given excellent results in the determinations made on natural phosphatic rocks, may, according to the author, be applied to any fertilising mixture containing acid phosphates, provided care is taken first to precipitate the sulphates by means of a solution of barium nitrate. As a proof of this, the author reports the results of some analysis made with the gravimetric and the volumetric methods, barium nitrate having been previously added. The results obtained by the two methods are perfectly concordant.

L. M.

810. **Phosphatic Manuring of Pastures in Western Australia.**

BARON-HAY, G. K. *Journal of Department of Agriculture, Western Australia*, Vol. II, N° 1, pp. 51-64, tables 7, plates 7. Perth, 1925.

The experiments described were carried out in order to demonstrate the value of phosphatic top-dressing for pasture and to ascertain the most economical manure to apply.

Demonstrations were made in each district and on all types of soil, 13 being made in 1922-23 and 25 in 1923-1924. Five acre plots were selected in each case, 2 acres being top-dressed with 1 cwt. of superphosphate per acre, one acre, no manure (control), and 2 acres received 2 cwt. of superphosphate per acre. Superphosphate was selected as it is easily obtainable and supplies phosphoric acid more cheaply per unit than any other phosphatic manure, in Western Australia. The manure was sown with a drill or broadcasted.

The results obtained showed that: Top-dressing with a phosphatic manure greatly increases both yield and quality of pasture; the average yield was increased about 2 ½ times. One cwt. of superphosphate per acre was found to be more economical than 2 cwt. W. S. G.

811. **Residual Effect of Acid Phosphate and Rock Phosphate.**

BAKER, W. G. *Journal of the American Society of Agronomy*, Vol. 17, N° 3, pp. 172-186; figs. 7, bibliography. Geneva, N. Y., 1925.

The author's experiments were carried out on Iowa (U. S. A.) soils in order to ascertain how long an application of phosphatic fertilisers will be of practical value to crops. An account is given of results obtained by other workers. Experiment Station reports, greenhouse tests and field experiments extending from 2 to 5 years were studied.

The residual effects of both acid phosphate and rock phosphate continued to be shown at the close of the tests.

The increases in yields from the acid phosphate were usually higher the first year than in later years. In the case of rock phosphate the gain was less the first year or two, after which it was about uniform to the close of the tests. Rich soils gave more and quicker response to rock phosphate applications than poorer soils.

Clover possessed a higher power to utilize [illegible] than [illegible] small grains. Early growth, maturity and quality [illegible].

High grade acid phosphate was more slowly available [illegible] on silt loams or loams.

Larger residual effects were shown from [illegible] phosphate on soil containing lime than on acid soils.

The rate of exhaustion of the phosphorus [illegible] acid phosphate was 12.3 % the first year, 8.9 % the second year and [illegible] the third year, or a total of 28.3 % in three years.

W. S. G.

812. **American Potash.**

TURRENTINE, J. W. (Bureau of Soils, Department of Agriculture, Washington, D. C. *Industrial and Engineering Chemistry*, Vol. [illegible], No. 11, pp. 1192-1193, November 1924.

The author after having discussed generally the potash industry in America, both during the war and after, states that, in order that this industry may develop on a solid economic basis, it will have to depend on other large industries. In other words, potash should not be obtained alone, but should always be obtained as a bye-product or together with bye-products. The present American production of potash which is calculated at about 25,000 tons of K_2O annually, is entirely based on three large industries (cement, borax and alcohol) and constitutes a bye-product of these industries. Surveys have been completed of the three industries mentioned above and also of the blast furnace industry, which show a total tonnage there producible of 225,000 tons.

Such being the case, the author predicts that the quantity of potash obtained as a bye-product of the great industries will increase from year to year. America has also a second and practically inexhaustible source of potash in her minerals such as the greensand of New Jersey, the [illegible] of Wyoming, the alunite of Utah, etc. According to the author, the problem of extracting potash from these minerals by an economical process has nearly been solved. In this way attempts are now being made to combine the production of potash with the production of alumina, one of the principal constituents of many potash minerals, a product of great importance to the aluminium industry.

Moreover, from recent observations already recorded, it seems that in some parts of America there exist pure beds of potash salts.

The author concludes by saying that America could, therefore, in a short time, draw abundantly from these three large sources, the amount of potash necessary for agricultural purposes, thus being entirely independent of European production.

L. M.

813. **The Utilization of Leucite as a Source of Alumina, Potash and Silica.**

BLANC, G. A. *Atti del Congresso Nazionale di Chimica Industriale*, Milan, 13-18 April, 1923.

In this article the author describes his special method for the treatment of [illegible] double metasilicate of alumina and potash — a mineral [illegible]

which is particularly abundant in the volcanic areas of central and southern Italy.

This method has been studied for the purpose not only of finding a practical way to extract potash from the leucite, but also to extract and utilize the alumina and silica.

The method proposed by BLANC consists in the following:

(1) The concentration of the leucitic substance by means of an improved system of magnetic separation, whereby, with no great expenditure of energy and but slight loss, the leucite can be concentrated to 95 %. The leucite thus separated (1) would have the following composition:

K_2O	18 %
Al_2O_3	23 %
$Si\ O_2$	55 %

(2) Treatment of granular leucite with strong mineral acids (hydrochloric, nitric or sulphuric. The treatment with hot solutions of hydrochloric acid has been particularly investigated by the author from the point of view of industrial application.

As final products of this treatment would be obtained: chloride of potash of a very high degree of purity (98-99 %), aluminium hydrate which, containing only traces of iron, could after previous calcination be directly used for the production of metallic aluminium, and pure silica, which in view of its physical condition can find various important applications in industry. L. M.

814. **Potash from Cement Dust.**

FOX, E. J. and WHITHAKER, C. W. (Bureau of Soils, Washington) *Industrial and Engineering Chemistry*, Vol. 16, No. 10, pp. 1044-1046. October, 1924.

The authors give the results of studies made with the object of finding a suitable method of recovering potash from the dust present in the gases generated in cement furnaces. This dust consists mainly of relatively large solid, particles, which are detached from the furnace walls; and of minute particles of potash salts, which are there mingled in a highly diffused state.

Many difficulties were encountered in recovering potash from these dusts by means of the different wet processes. However, a dry process has been tried successfully, to separate from, or better still, to enrich these dusts with potash, by making use of compressed air.

The authors report the results of the experiments, carried out according to this method, by two large Americans firms (Riverside Portland Cement Company, and Security Cement Lime Company) from which they

(1) The author refers to the leucite obtained from the leucitic beds of the volcano Roccoamonfina.

maintain that in the finest fractions there is twice as much potash, as in the original material.

In all the fractions of any given specimen, the potash content decreases in relation to the increasing size of the particles. Hence, it is a question of a phenomenon of superficies, that is to say, that potash, instead of being simply mixed, as was the case of the other materials constituting the dust, is disseminated over the surface of the particles, and further is regularly distributed over the whole surface. The enrichment obtained would thus be due to the increase of surface aggregates obtained with the finer fractions.

S. M

815. Increasing Ammonia Production with Improved Catalysts.

LARSON, ALFRED T. (Fixed Nitrogen Research Laboratory, Washington, D. C.). *Industrial and Engineering Chemistry*, Vol. 16, No. 10, pp. 1102-1004, October 1924.

The author draws attention to the fact that whereas in the literature on the subject there are minute descriptions of the technical details of the various processes used for obtaining ammonia, by direct combination, in the presence of a catalyst, of nitrogen and hydrogen, there is little regarding the catalysing mass.

This note gives the results of some researches made in recent years in the Fixed Nitrogen Research Laboratory at Washington on this important question. In these investigations it was borne in mind what had already been proved for some time, at first scientifically and afterwards in practice. Thus, though a large number of metals were proposed by various experimentors (osmium, ruthenium, molebderum, uranium, cerium, manganese, iron, nickel, etc.), in the course of these experiments only iron was examined as a catalyst, alone or with the addition of a small quantity of other substances (oxides, hydroxides, alkaline salts and alkaline earths), called "promoters", which greatly increase its catalyptic properties. The author points out that not all "promoter" substances produce the same effect. During the experiments, the object of which was to determine the various effective values of these different substances, mixtures of two or more were also examined. It was found that none of the substances used alone, produces on the catalyptic properties of iron the effect produced by the mixtures of two or more of them, when properly chosen. In order to demonstrate the superiority of a compound promoter, the author gives the data of some laboratory experiments made on the same gaseous mass, under the same conditions, by using as a catalyst mass in the first instance iron plus small quantities of aluminium oxide, and in the second case, iron plus small quantities of soda, potash, and thirdly, iron plus small quantities of a combination of aluminium oxide and potash.

The first time 8 % of ammonia was obtained
" second " 5 % " " " "
" third " 14 % " " " "

Combinations of caesium and aluminium, caesium and zirconium and potassium and zirconium also gave excellent results.

The author also points out the technical advantages following the use of a catalytic mass formed of iron plus a compound promoter. It is very important to be able to work at a lower temperature than that generally used in commercial practice ; 475°C. under certain conditions, gives excellent results, also 450°C. The activity of the catalyst at this temperature lasts much longer. Also the efficiency of the catalyst formed by iron containing a compound promoter remains high even when the pressure is increased, in contradistinction to the other catalysts ; it is possible even to work at 1500 atmospheres pressure without any appreciable loss of efficiency. Recent experiments have shown that at this pressure from 70 to 80 % of the reacting gases can be converted into ammonia by simply passing them through the catalyst.

To ensure a good yield in the preparation of ammonia by the catalytic process, iron alone being used, and at a low temperature, a more complete purification of the gaseous, hydrogen-nitrogen mixture is necessary, because the presence of traces of impurity greatly diminished the yield. Commercially this is a serious obstacle, for the purification of the gaseous mixture involves considerable expense. The author however has heard that recently a new method has been examined and proposed, the object of which is to obtain very pure gases, without any greater expense being incurred in practice. This would render it possible to utilize commercially this very active and highly efficient type of catalyst.

Finally the author observes that the preparation of this iron type of catalyst requires great accuracy. The various iron oxides may be used for the purpose ; the use of artificial magnetite however has given better results. In the preparation the promoter substance is accurately added to the iron oxide under pressure. The reduction process however is generally done not with pure hydrogen, but directly with the hydrogen-nitrogen mixture used for synthetizing the ammonia. L. M.

816. A Colorimetric Method for Determining Nitrate Nitrogen.

SCALES, F. M. and HARRISON, A. B. (Division of Soil Bacteriology, Bureau of Plant Industry, Washington). *Industrial and Engineering Chemistry*, Vol. 16, No. 6, pp. 571-572. June 1924.

The authors describe a new colorimetric method for determining nitrates. The reagent proposed (strychnine reduced for use in the presence of concentrated sulphuric acid) is very sensitive and the method may therefore be employed in determinations of biological solutions containing a very small quantity of nitrates. The presence of chlorides is no drawback. The interference of coloured extracts is practically eliminated, being able to operate in considerable dilutions.

Only in the presence of peptone can this method not be used.

The proposed method is simple, rapid and easily carried out. The authors describe minutely the preparation of the reacting agent, which requires great accuracy. L. M.

817. Pot and Field Experiments with Common Salt.

BARNETTE R. M. *Journal of the American Society of Agronomy*, Vol. 17, pp. 125-129, table 3. Geneva, N. Y., 1925.

The value of common salt as a direct or indirect fertiliser, and the question of posible injury from fertiliser salts containing relatively large proportions of common salt is important. However, unless a great amount of information as to a given soil is available the results of the application of salt cannot be forecasted.

From the results of pot experiments it appears that salt has a slight stimulating influence when applied in amounts of 200-300 lb. per acre, but when applied at the rate of 600 to 800 lb. per acre there is a slight depressing influence on the crop.

The field tests showed that the effect of salt in general practice is uncertain, and depended on so may factors that results cannot be predicted.

The application of common salt under certain conditions may have a favourable influence, but would probably not pay for the cost of material and time required.

W. S. G.

818. The Effect of Manganese on the Growth and Y eld of Rice.

JIMENEZ, A. L. *Philippine Agriculturist*, Vol. XIII, No. 7, pp. 299-303, bibliography. Los Baños, Laguna, 1924.

The author carried out a series of experiments with pot cultures of rice, in order to ascertain the effect of manganese compounds on this plant.

The conclusions drawn from the results obtained were as follows:

Manganese dioxide, sulphate and chloride at certain concentrations proved to be beneficial and increased both the yield of grain and straw. The optimum concentration varied with the manganese compounds. The lowest concentration of the sulphate was beneficial, whereas higher concentrations were harmful. The chloride in the concentration of 0.22 % manganese gave a decrease in grain, but an increase in straw. Manganese dioxide proved beneficial to growth and increased yield in all cases.

The addition of lime appeared to counteract any beneficial effect of manganese on rice, and to accentuate detrimental effects.

W. S. G.

819. Manganese Chlorosis of Pine Apples, its Cause and Control.

JOHNSON, O. M., *Hawaii Agricultural Experiment Station. Honolulu, Bulletin No. 52*, pp. 38, plates 4, bibl. Washington, D. C., 1924.

A review is given of former investigations on manganese. The chlorotic effect of higher concentration of manganese has generally been attributed to a "toxic", effect of the manganese, it was not shown that the effect was due to a deficiency of iron.

The author's investigations show that in the Hawaiian soils manganese is mainly present in the dioxide form, and that the soils are acid, and calcium carbonate is absent.

Nutrient solutions containing a normal amount of iron, manganese sulphate and manganese dioxide, caused strong chlorisis and severe depression in plant growth. This chlorisis was overcome when the leaves of the plant (rice) were dipped in a solution of iron salts, or the amount of iron in the nutrient solution was greatly increased.

Manganese chlorisis is quite distinct from lime chlorisis, due to calcium carbonate.

No evidence was found to show that manganese exerts any stimulating effect on plant growth.

The difference in solubility of ferrous and ferric iron affords an explanation of the manner in which manganese induces chlorisis. Manganese dioxide would keep the iron present oxidised to the less available, ferric form.

Solutions of iron salts were applied to the leaves of chloritic pineapple plants, and effected immediate cure of the " toxic effects " of manganese, and induced normal growth. The most economical and effective treatment appears to be that of spraying the plants with an approximate 6 % solution of iron sulphate. No injurious results were found even when an 8 % solution was applied in a fine spray on young plants. The solution should be applied as soon as any signs of yellowing appear.

W. S. G.

820 **Recent Progress in Insecticides and Fungicides.**

MACDONNELL, C. C. (Bureau of Chemistry, Washington, D. C.) *Industrial and Engineering Chemistry*, Vol. 16, No. 10 pp. 1007-1012, bibliography. October, 1924.

The author alludes to the great progress made in recent years in the insecticide and fungicide industry, and the fact that this industry has extended and become of the utmost importance to the economic prosperity of every country.

After having pointed out that both in the study and application of the various products in use, a great number of facts must be born in mind (climatic conditions, chemical composition of the product used, nature of the matter secreted by the plants, etc.), he reviews the more important insecticide and fungicide products to-day prepared industrially.

Insecticides : The various arsenical compounds (white arsenic, arseniate of lime, arseniate of lead, arseniate of magnesium, various mixtures of arsenical compounds) are described.

White arsenic or arsenolite is the most important raw material for the preparation of all insecticides having a basis of arsenic. All the progress which has recently been made in the preparation of arsenious acid, beginning with arsenolite, may be indirectly regarded as progress in the field of arsenical insecticides.

The author describes some among the numerous methods proposed for the preparation of the various arseniates and briefly summarises important investigations regarding the chemical, physical and insecticide

properties of such products and the compatibility or otherwise of certain combinations of insecticides and of insecticides and fungicides.

Reference is made in this connection to the oil emulsions prepared with heavy mineral oils, which have recently been greatly developed. Details are given of preparations containing substances furnished by certain plants, which may be called insecticides: among these preparations the most important are those containing nicotine. The so-called *nicotine powders* are formed of a finely ground mineral substance in which nicotine sulphate or free nicotine is incorporated. At first only kaolin was used in preparing these powders, afterwards numerous investigations and researches were made on the use of various other substances (quick and slack lime, carbonate of lime or magnesia, chalk, talc and kieselgur).

Some preparations formed from soaps containing nicotine have also been placed on the market. These products however have shown a strong tendancy to deteriorate (*e. g.* oil of nicotine).

Flowers of *Pyrethrum* also are much used in the preparation of insecticide powders. The author alludes to the numerous and interesting investigations made recently with a view to isolating the active principle contained in the species most commonly used (*Chrysanthemum cinerariaefolium*). Many insecticide powders to day are prepared by extracting flowers of *Pyrethrum* with the lightest fraction of the minerals oils in which the active part is soluble.

Derris elliptica also contains a typical constituent and its roots are used to day for preparing very active insecticide powders.

From the seeds of the *Delphinium Consolida* and from the roots of a Peruvian plant locally called "cube" or "barbasco", insecticide powders are prepared which seem to promise very well for large scale application.

The author then alludes to some investigations on some organic compounds which possess insecticide qualities for certain species of aphides. Pyridine, picoline and commercial pyridine (containing high homologues of pyridine) have, as contact insecticides, very little value. The alkaloids, with the exception of nicotine, also mostly have a low toxicity. Dipyridile, which has recently been prepared from pyridine, seems on the other hand to possess a high efficacity. The author then speaks of some toxic gases much used on account of the insecticidal properties they possess. First among these is cited hydrocyanic hydric acid in the gaseous state. To-day the use of liquid hydrocyanic acid (easily vaporized) has quite replaced the old system of generating hydrocyanic acid from cyanide and sulphuric acid. Experiments have been made to try the insecticidal properties of hydrocyanic acid gas on various fruits, especially citrous fruits, and on cotton. The results were promising.

Very energetic action in the destruction of insects is exercised by the gases evolved from a mixture of ethyl acetate (2 volumes) and carbon tetrachloride are very destructive to insects. This mixture, which has been proposed as an insecticide recently, possesses the very important property of not being inflammable. It is very active, especially against insects which infest stored grain, and has the advantage of not leaving

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unpleasant taste or odour in the products subjected to the action of its vapours.

This new insecticide costs rather more than carbon disulphide, but as it is easily applied, is not poisonous to man, nor inflammable, nor does it cause explosions, it is preferable to carbon disulphide in every case where the use of the latter may be dangerous.

Another gaseous insecticide which has proved very useful in the case of cereals, is chloropicrin, which has been largely tested in recent years.

Carbon disulphide has shown itself very active, experimentally, in the destruction of the larvae of the Japanese beetle, when placed in holes in the soil. This treatment however is not effective when the soil is wet.

The author terminates this review on insecticides by alluding to the various treatments for protecting wood from the attacks of termites and other insects. Among others, the hydrocyanic gas and volatile arsenical compound treatments are deserving of mention. Crude phenol and creosote are also to be recommended as poisonous substances of marked effect, when added to wood pulp during its manufacture.

Fungicides : the author then alludes to the use of copper and mercury compounds, sulphur, and calcium sulphide solutions. Among copper compounds is mentioned copper carbonate powder (basic carbonate) which has shown itself very effective against smut on wheat seed, but only slightly so against oat smut.

A new fungicide is copper soap powder, prepared with copper sulphate, resin soap and fish oil, which has given excellent results in practical applications, owing to its high fungicidal properties, which are equal, if not superior (on account of its easy application) to Bordeaux solution.

Another copper salt mentioned by the author on account of its promising results is acetate of copper and, especially, basic acetate. As regards mercury compounds, a large number of compounds of mercury (derived from phenol and products homologous to phenol) have been studied for treating seeds of Graminae and have generally shown themselves good fungicides.

As regards the fungicidal properties of sulphur, the author points out that, as is shown from numerous investigations, the toxic action is developed only in the presence of oxygen and water and is due to the formation of pentationic acid, produced by the oxydation and hydration of sulphur. This explains why precipitated sulphur and colloidal sulphur, in a state of fine subdivision, being therefore more easily oxydizable, are more effective than ground sulphur.

Allusion is made to investigations on the manufacture and use of solutions of polysulphides of calcium.

To render insecticide and fungicide powders efficacious, they must adhere well to the plants, for this purpose special adhesive substances are mixed with the various products. Among the substances used for this purpose slaked lime is important, and has been the subject of numerous investigations.

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Whey and calcium hydrate have recently been proposed as substitutes for slaked lime.

In recent years the practice of using powders in the dry state has been replaced by that of dusting with moist powders, whenever it is possible to do so, for the latter method is better and quicker.

Examples are given of applications of arseniate of lead and calcium, carried out in America on a large scale by the use of aeroplanes, in large plantations of catalpa and cotton, which have given very satisfactory results. The author terminates by alluding to some investigations on the electrification of the particles forming the insecticide powders, and especially the arseniates with separate particles should be charged with positive electricity so that they may be attracted by the electro-negative charge presented by the wet surface of the leaves. A strong adherence would thus be obtained.

L. M.

821. **Some Chemical Problems of the Insecticide Industry.**

DICKENSON J. R. *Industrial and Engineering Chemistry*, Vol. 16, No. 10, pp. 1013-1015, October 1924.

The author shows that chemistry plays an important part in the insecticide industry, the principal points connected with chemical science in this industry being three in number: (*a*) the chemical composition of the material manufactured, (*b*) the cost of production, and (*c*) the efficiency of the product. In insecticide factories a continuous and accurate chemical control is necessary in order to obtain a homogeneous product which will always be of a definite composition. Further, it is necessary to prepare these substances in such a way that the product is not affected by time or weather.

Besides carrying out the chemical control, the chemist in this industry should also seek the most economical mode of preparation.

However, the use of a product of great efficiency and high cost may be more suitable than that of a less effective product of low cost. It is necessary to kill the largest number of insects or fungi with the minimum consumption of material and labour.

Also as regards a correct application, the aid of the chemist is necessary, for by his analytical researches he can help the entomologists and plant pathologists to determine the lethal doses for various species of insects and to interpret the various results obtained. Further, the chemist by determining the residue found on the leaves and other parts of the plants at varying intervals of time, after the application, under various climatic conditions, in dry and wet weather, etc., is also enabled to supply the necessary data for ascertaining the best time for making the application.

L. M.

822. **The Determination of Free Calcium Hydroxide in Commercial Calcium Arsenate.**

SMITH, C. M. and HENDRICKS, S. B. (Insecticide and Fungicide Laboratory, Bureau of Chemistry, Washington, D. C. and Delta Laboratory, Bureau of

Entomology, Tallulah, La.) *Industrial and Engineering Chemistry*, Vol. 16, No. 9, pp. 950-951. September 1924.

The authors describe the analytic results obtained, by a new method in the determination of free calcium hydrate in the presence of carbonate and various arsenates of calcium. The method proposed consists in treating the sample under examination with an excess of acidified alcohol of known value and then making the back titration by using a titrated solution of potash or caustic soda in alcohol.

Experiments were made with alcoholic solutions of hydrochloric acid, acetic acid and benzoic acid. The best results were obtained with benzoic acid, which was used by the authors in 0.1 N solution of 93 % ethyl alcohol. Phenolphthalein was used as an indicator, and for the back titration — during which, the liquid must be continually shaken — a solution of 0.1 N caustic soda in 93 % ethyl alcohol was used.

From the data drawn up it was shown that the method gave excellent results (approximation of 0.02 %) on a mixture of known composition.

The method is not so perfect in the presence of magnesium compounds. The authors, seeing that many of the commercial calcium arsenates contain considerable quantities of magnesium, are investigating a suitable modification of this method, in order to obtain reliable results also in the presence of magnesium. L. M.

Agricultural Botany, Chemistry and Physiology of Plants.

823. **Agricultural Ecology.**

GRAY W. S. *Agricultural Progress*, Vol. II, pp. 24-28, bibliography. London, 1925.

Agricultural meteorology, plant breeding and other allied sciences have been studied by many investigators, but a correlation of these studies is now required.

Agricultural ecology attempts to determine by the study of specific differences in growth and other characters, what varieties of cereals, etc., are suitable for cultivation under any given climatic or environmental conditions.

The limiting factors of a crop may be physical, chemical or biological, and the investigations of the meteorologist, chemist ad genetist may often form different phases of a larger problem, hence the importance of co-operation, and also of a central directive body to act as a clearing house for information.

The importance of breeding rust-resistant varieties of wheat is evident but because a wheat is resistant, it does not follow that such will be the case under other conditions. In the description of such a variety should be recorded the climatic and other conditions for which these qualities hold.

The problem requires the collection of data respecting rainfall, soil humidity, temperature, etc., also data relative to particular crops, for instance, times of sowing and harvesting ; such knowledge is essential to the

plant breeder to enable him to obtain, or select the type most likely to succeed in a given environment.

The "critical periods" of a crop have special significance. By the term "critical period" is understood the interval during which the plant reaches the maximum sensibility to a given factor, and during which variations in the intensity of that factor will have the greatest effect on yield. The 20 days before heading constitute a critical period for wheat, in relation to humidity. If during that period the rainfall is less than the minimum needed for the normal development of the plant, the crop will be small, even if there is abundance of rain later on. The critical periods always coincide with certain phases of growth, during which certain climatic conditions are essential if development is to proceed at a maximum rate.

The influence, both of the time of application and the quantity of water has been shown by the experiments of Prof. AZZI at the Botanic Gardens of the University of Rome, on four varieties of wheat. KOENIG has shown the existence of critical periods in the case of sugar cane, from data collected over a series of years from 27 stations in Mauritius.

It is not the absolute value of a meteorological factor that counts, but its distribution during the different stages of the growth period of the plant.

The yield of a crop is the result of a compromise between productivity and the degree of resistance to adverse environmental factors. At Svalof, a hybrid wheat, Pansar, yielded 67 % more than the local wheat; this hybrid was grown at other stations farther north, and a point was reached where the temperature factor became important and the local type yielded more than Pansar, owing to the greater cold-resistance of the former.

Briefly, the aim of agricultural ecology is the determination of the climatic zones of wheat and other plants throughout the world, and the co-ordination and direction of research, the ultimate object being the possibility of stating definitely what crop, and what particular variety of the crop, is most suitable for any given climatic and evironmental conditions.

To Prof. PIROTTA of the Accademia R. dei Lincei, Rome, and to Prof. AZZI is due the foundation at the R. Accademia, of the International Institute of Agricultural Ecology which has been recently established.

W. S. G.

824. **The Origin and Geographical Affinities of the Flora of California.**

LE ROY ABRAMS (Stanford University). *Ecology*, Vol. VI, No 1, pp. 1-6. Brooklyn, N. Y., 1925.

The geographical distribution of plants is governed by the following laws: (1) Plants persist only when the environment is favourable to their growth and reproduction; (2) Different species of plants need different environments; not all plants thrive under the same temperature, moisture and soil conditions; (3) The individuals of a species, and in a wider sense the members of a genus, have common predecessors and a common centre of origin, from which their descendents have migrated.

The author, having studied the flora of California, especially from this point of view, has come to the conclusion that the flora of lofty mountains

is of northern origin and composed of genera common to the northern part of North America and of Eurasia.

The flora of the deserts, on the other hand, is of Mexican origin. That of the 'cismontane' region, which is presumably the Californian type, is composed of both these elements with some other endemic and surviving forms. Such a region had an oceanic rather than a continental climate from the Cretaceous epoch, and the flora has therefore been less disturbed than in the eastern parts of the United States by the great climatic changes of the Tertiary epoch. Hence the surviving *Sequoia* and *Tumion* forms. The antiquity of the flora is also proved by its affinity with that of Southern Asia, the Mediterranean region and the antipodes. A. F.

825. **Relation between Structure and Chemical Nature of the Beetroot.**

COLIN, H. and GRANDSIRE, A. Structure et Chimisme dans la betterave, *C. R. de l'Académie des Sciences*, Vol. 180, No. 3, pp. 599-601. Paris, 1925.

The beetroot can be advantageously used for the separate study of the conducting tissue and the interstitial parenchyma. In fact a transverse section of the root of a beet shows clearly the separation of the different elements; in the centre a simple woody cord, around which are eccentric zones of bundles, separated one from the other by the parenchyma. As the veins in these roots have a clearly marked direction, it is possible to isolate in the pulp the parts containing woody bundles or those without any vascular elements, and thus to proceed to a separate analysis of the different elements. In this way it is possible to obtain an idea of the distribution of the substances, according to the constituent elements.

In the vascular tissue there is a large amount of dry substance, and consequently also of sugar, while on the other hand the mineral salts predominate in the parenchyma; in the latter the shortage of sugars is counterbalanced by the concentration of the electrolytes, so that, if the index of refraction is lower, the electric conducibility is higher in the parenchyma.

The content in organic nitrogen is much the same in the two elements (about 0.14 %), taking into consideration the percentage of hydration, the dry substance in the conjunctive tissue being richer in nitrogen than that in the vascular tissue.

The parenchyma contains about twice the quantity of reducing sugar as compared with the bundles and also a greater proportion of sucrose; the oxydising enzymes are however chiefly located in the bundles.

It is generally assumed that the reaction of the tissue of the liber is alkaline; the authors however have not been able to confirm this opinion and could only observe that in any case the vascular areas have the same reaction as the parenchyma, the P^H value being always nearly 6.

The observations of the authors therefore demonstrate that in the interior of a single root the chemical nature depends on the structure, however uniform is the osmotic pressure. This has a practical bearing on the analysis, which should be made on entire sections.

The experiments have been made on forage beets, on account of the difficulties which are found in taking samples of sugar beets, the latter being generally speaking, all veins. A. F.

826. **The Nitrogenous Metabolism of the Higher Plants.**

CHIBNALL A. C. (Biochemical Department, Imperial College of Science and Technology). *Biochemical Journal*, Vol. XVIII, No. 2, pp. 336-407. Cambridge, 1924.

In this part of his work, which is a continuation of previous investigations, the author draws the following conclusions:

(1) During the night the protein content of bean leaves diminishes, in consequence of the breaking down of the cytoplasmic material. The products of this protein decomposition are removed from the leaf.

(2) The products of decomposition consist in great part of asparagine and other substances of undetermined composition containing free aminic nitrogen. It seems that the asparagine serves to transport the nitrogen from one part of the plant to another in a form adapted to the new synthesis.

(3) In certain conditions, not yet determined, the metabolism of the leaf nitrogen may undergo variations. In certain cases, in which no formation of asparagine was observed, there was no production of bean pods.

A. F

827. **Hydrocyanic Acid as a Toxic Agent to Plant Growth.**

HAWKINS R. S. *Journal of the American Society of Agronomy*, Vol 17, No 3, pp. 169-171. Geneva. N. Y. 1925.

The author's experiments were carried out on peas, barley, sorghum and vetch seedlings, grown in CRONE's nutrient solution, to which potassium cyanide was added in concentrations equivalent to 0.5 to 10 parts per million of hydrocyanic acid.

The cyanide has a marked effect on the roots of all the seedlings; secondary roots decreased in development with cyanide concentration until with a concentration of 10 parts per million there were no secondary roots.

A cyanide concentration equivalent to 0.5 part per million HCN had a stimulating effect on barley, sorghum and vetch seedlings, but on peas has a depressing effect.

Hydrocyanic acid, if present in the soil solution at a concentration of 1 : 1000 000 would probably depress plant growth in most instances.

W. S. G.

828. **The Feeding Power of Plants in Different Soil Horizons.**

MILLAR, C. E. *Journal of American Society of Agronomy*, Vol. 17. No 3 pp. 150-156, figs. 4 bibliography. Geneva, N. Y. 1925.

Difference of opinion exists regarding the relative unproductiveness of soil below the humus-bearing horizon, usually termed "subsoil".

The growth of oats and inoculated sweet clover on different horizons of Fox sandy loam and Miami silt loam, indicate that different crops may have quite different feeding powers in the various soil horizons.

The small growth of sweet clover on the brown layer of maximum clay of the Fox soil, throws some doubt on the conclusion sometimes drawn from field observations that an accumulation of roots in a horizon of this type indicates a supply of available nutriments. W. S. G.

829. Athmospheric Electric Currents, Normal and Abnormal, and their Relation on the Growth of Plants.

BLACKMAN, V. H. *Quarterly Journal of the Royal Meteorological Society*, Vol. 50, No. 211, p. 197-207, figs. 2. London, 1924.

The effects of normal atmospheric electric currents have been firstly investigated by surrounding each pot plant with a steel-wire cage, so as to disperse the electric currents which could influence the plants. In this way it was possible to notice a small but constant diminution of the crops of the plants thus freed from the influence of electric currents.

When through the properly isolated wires an electric current at high voltage was sent, a larger crop was obtained. The intensity of the current, however, is of definite importance, as by currents of 10^{-10} amp. the crop was favourably affected, whilst by those of 10^{-8} it was diminuished. Furthermore, the results obtained were still better, if, instead of continually applying the current during the full period of the growth, it was limited to one month only, for instance the second. This shows that the growth of the plant and its crop are differently affected by the currents, which fact is proved by the increase in grain yield, which is much greater than the increase in total dry weight.

The effect produced by electrification, however, is out of all proportion to the energy furnished ; therefore the physiological action of the currents must be considered as stimulating. Furthermore, it results from laboratory experiments that one of the physiological effects of the smallest electric discharges is to accelerate the rate of growth. A. F.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES.

Cereals, Roots and Forage Crops.

830. New Varieties of Wheat in Queensland.

QUODLING, H. C. (Director of Agriculture, Queensland) *Queensland Agricultural Journal*, XXIII, No. 4, pp. 321-329, plates 19. Brisbane, 1925.

Thirteen new varieties of wheat, suitable for Queensland conditions, have been produced as the result of several years work of Mr. SOUTTER, the manager of the State Farm, at Roma.

In Queensland the rust problem transcends all others ; the losses from rust have been very great on several occasions.

The names, and very brief particulars of the 13 varieties are given in the article.

W. S. G.

831. **Varietal Experiments with Red Winter Wheats in Dry Areas of the Western United States.**

CLARK, J. A. and MARTIN, J. H. *United States Department of Agriculture Bulletin, No.* 1276, pp. 47 tables 26. Washington, 1925.

The average precipitation at 10 field stations in the Great Plains is between 14 and 23 inches per annum, and in the Great Basin area, between 7 and 14 inches.

Data regarding yield, height of plant, time of maturity, stem-rust, weight per bushel, are given for 110 varieties and strains of winter wheat. Samples of the more important varieties were milled and bread was made from the flour.

Three classes of winter wheat were compared : hard red winter, soft red winter, and white ; the hard red winter wheat consistently outyielded the other classes of winter wheat.

Strains of Kharkof were selected as the standard for comparison; this wheat was found to be equal or slightly superior to Turkey, the leading variety of hard red winter wheat, in yield, winter hardiness, and in milling and baking quality.

Kanred was found to be the most productive hard red winter wheat for the Great Plains area. Other highly yielding strains are Alberta Red, Argentine, Beloglina, Blaskhull, Karmont, Montana No. 36, Nebraska No. 60, and Turkey (C. I No. 1571).

In winter hardiness Minturki, and in stem-rust resistance Kanred exceeded other varieties.

For milling and baking value Beloglina, Kanred, and Minturki have one or more advantages over Kharkof and other hard red winter wheats.

W. S. G.

832. **The Effect of Spacing on the Yield of Wheat.**

ENGLEDOW, F. L. (Plant Breeding Institute, Cambridge). *Journal of Agricultural Science,* Vol. XV, Part 2, pp. 125-144, tables II, figs. 3. London, 1925

Grain is an end-product of all the vital processus of a plant's life, hence, yield must reflect those processes. An analysis of yield would simplify the testing of new plant forms : the analysis should include the vital processes of the plant, the effects upon them of environmental factors and their relation to grain production. At present, such an analysis cannot be made ; only an algebraic analysis is practicable, the simplest form of which is : $Y = pcng$, Where Y = yield, p = average number of plants per unit area, c = average number of years per plant, n = grains per ear, and g = average weight of a single grain.

The first factor p is the key to the resolution of Y as in general c, n and g are dependent upon p. Any cereal varies in yield with different

inter-plant spacings, hence yield in field crops has great dependence on spacing.

Tests which merely give gross yields can afford no analytical information. No details are given of inter-form difference, which in plant-breeding it is desirable to know.

Tests fall into two chief categories, small scale and field tests. Field tests of cereals, drilled in the usual manner have the advantage of including the usual wide range of field spacings. They are capable of showing differences of 2-5 %. But they are subject to variations of weather, and of soils, hence repetitions in many places, and for several years are required. Also, yield testing on a field scale is often limited to sowing, harvesting and calculating; they are costly, non-analytical and unsuited to be the sole tests.

In assessing such a complex as yielding capacity, the chess-board plot test, the spacing plot, the field test, and the observation crop should all find a place. In deciding the relative importance of each of these, regard must be paid to convenience of working and expense.

W. S. G.

833 **Inheritance of Resistance to *Puccinia graminis* in Crosses between Varieties of Durum Wheat.**

HARRINGTON J. B. (University of Saskatchewan). *Scientific Agriculture*, Vol. V, N° 9, pp. 265-288, tables, 9, plates 5, bibl. Ottawa, 1925.

The investigations were carried out to study inheritance of rust resistance in durum crosses, with reference to the study of the number, location, and nature of the genetic factors involved.

Hybrid families of two *Triticum durum* crosses were used, Kubanka No. 8 × Pentad, and Mindum × Pentad.

A study was made of the parasitic capabilities of four physiologic forms of *Puccinia graminis Tritici* on F_3, F_4, and F_5 progeny from crosses between three varieties of *Triticum durum* (Kubanka No. 8, Mindum and Pentad).

The four physiologic forms, 1, 17, 21 and 34 employed were consistent in their reaction on twelve varieties of wheat.

A total of 23 620 hybrid seedlings and 3 680 seedlings of parental varieties were inoculated. Pentad was resistant and Kubanka No. 8 slightly susceptible to form 34. Apparently Kubanka No. 8 and Pentad contain different factors for resistance.

In reaction to form 1, Mindum is very resistant and Pentad is slightly susceptible. The results obtained indicated the presence of two independently inherited factors, one dominant for immunity and present in Mindum, the other almost completely hypostatic to the first, but dominant for slight resistance, and carried by Pentad.

Mindum × Pentad hybrids were inoculated with form 34 in the F_3 and F_4 generations. Mindum is susceptible and Pentad resistant to this form. None of the 27 F_3 lines tested in F_4 proved to be like Mindum or Pentad. The results indicated the presence of more than one factor for resistance.

Mindum is susceptible and Pentad resistant to form 21. The results were similar to those obtained with form 34.

Reaction to rust was found to be inherited in the same manner as other characters.

No relation was found to exist between rust reaction and seed colour.

Experiments with Mindum × Pentad hybrids indicated the presence of more than one genetic-factor difference for each of the characters, rust reaction in the nursery, erectness of plant, height of plant, and earliness of heading.

There appeared to be a slight linkage between the inherited factors which govern resistance to rust in the field, plant height, erectness, and time of heading. Hybrids which resembled Pentad in rust reaction also tended to resemble Pentad in other characters.

W. S. G.

834. A New Variety of Oats.

ZAVITZ, C. A. (Ontario Agricultural College, Guelph). *Scientific Agriculture*, **Vol. V, No. 8, pp. 246-249. Ottawa, 1925.**

A new variety of oats has been produced at the Ontario Agricultural College, Guelph, and has been named O. A. C. No. 144. This new variety has surpassed the O. A. C. 72 by an average annual yield in the College tests over a period of seven years. It was included in cooperative experiments with other varieties on 80 Ontario farms in 1923 and on 310 in 1924. The seed is not yet available in large quantities.

The O. A. C. No. 144 is a tall, broad-leaved, stiff-strawed, late variety, with a spreading head and a long, slightly brownish-white grain, almost free from awn, and gives a heavy yield of both grain and straw.

Application for registration of the new variety has been made to the Canadian Seed Growers' Association.

W. S. G.

835. The Origin of Maize.

BLARINGHEM, L. Note sur l'origine du maïs. Métamorphose de l'Euchlaena en Zea. *Annales des sciences naturelles : Botanique*, Vol. VI, No. 3-4, pp. 245-263, 6 fig. Paris, 1924.

Maize is at yet unknown in the wild state. The author has for some time demonstrated the affinity existing between the wild species Euchlaena of Mexico, where it is known as "Teosinte" and maize, forseeing that a search for plants with closely grouped blossoms in the "Euchlaena", followed by repeated selection of plants showing extreme condensation of blossoms would lead to the production of maize. Such a metamorphosis would be indeed strange, because it would treat of a direct transition between two species.

The present study of the Author, made on samples harvested at Bento di Toledo, from the Institute of Agriculture of the State of St Paul (Brazil) has shown that it is possible to follow the stages of a progressive metamorphosis from one plant to another. In the first place, there is a thickening of the axis which becomes fleshy and bears a large number of

series of ears. In addition the ears are arranged in pairs on a double row, while in Euchlaena they are placed singly. Finally, in the genus Zea, the ears unite and contain two flowers as in the transition state of the blossoming time. But in these latter the double ears with a single seed and one barren ear of the "maize" type, alternate with the independent double ears, some of which retain the characteristics of Euclaena.

This fusion leads to the supposition that this is a hybrid between the cultivated Zea and the true Euchlaena. Nevertheless it does not depreciate the value of the essential fact that a selection extending over some years might assist in the transformation of a blossom of the type Euchlaena into one of the type Zea. A. F.

836. **The Relation between Seed-Ear Characters and Productiveness in Maize.**

RICHEY, F. D. and WILLIER, J. G. *United States Department of Agriculture Bulletin No.* 1321, pp. 18, tables 10. Washington, D. C., 1925.

In the author's studies data were used from experiments extending from 9 to 14 years, with each of 4 varieties of maize includiug 3265 ears.

(1) Accidental variation in soil and experimental conditions were responsible for perhaps 90 % of the total variation in yield.

(2) From 2.5 to 6.7 % of the total variation in yield in the different varieties was a function of variation in the ear characters studied.

(3) Yield was found to be related positively to weight of ear and length of ear and negatively to number of rows and number of kernels per row in each ef the 4 varieties. Similarly yield was related positively to butt circumference and weight of cob and negatively to tip circumference in each of 3 varieties, the relations being reversed in the fourth variety.

(4) Selecting longer, heavier ears with proportionally heavy cobs and with relatively few rows of wide, thick kernels is warranted as a means of obtaining a supply of good seed for general planting. W. S. G.

837. **Improvement of Paddy Varieties.**

ILIFFE, R. O. (Economic Botanist, Department of Agriculture, Ceylon). *Tropical Agriculturist*, Vol. LXIV, No. 3, pp. 131-139. Peradeniya, 1925

During the past five years work has been carried out at the Experiment Stations of Anuradhapura and Peradeniya, in order to isolate high-yielding pure lines of paddy from the mixtures generally cultivated by growers. The result has been that a number of strains have been obtained which are capable of giving yields greatly in excess of the average paddies. These strains are now being tested in various rice-growing districts, as certain strains appear to be suited to particular localities.

One of the most successful strains is that known as B-12, which formed one of 30 strains of variety No. 33. The grain characters of B-12 are grain medium to large in size ; awnless ; colour, bright rusty yellow with slightly darker longitudinal streaks , seed-coat, bright reddish brown,

endosperm, flinty with a trace of starch. At the Experiment Station the average yield of cleaned paddy for the last three years was 3618 lb. per acre and the average period of growth 181 days.

Most of the selected strains will be available during 1925 in quantities varying from 4 to 20 bushels.

W. S. G.

838. **Variety Trials of Potatoes in England.**

University of Leeds, Bulletin No. 139, pp. 16, tables 8. Leeds, 1925.

The Bulletin gives an account of a series of tests carried out from 1920 to 1924 on varieties of potatoes, in order to study the respective yields and immunity or susceptibility to Wart Disease (*Synchytrium endobiotica*). The chief results obtained are summarised in the following table:

Average Yield of Ware Potatoes at Three Centres

(in tons per acre).

Variety		Osgodby	Bridlington	York	Number of years grown
Early:					
Dargill Early	(I)	9.7	7.287	5.2	4
Immune Ashleaf	(I)	7.45	7.262	9.825	3
Ally	(I)	12.85	10.65	11.45	3
Second Early:					
Great Scot	(I)	12.8	12.95	15.025	5
Arran Comrade	(I)	10.125	10.45	11.75	5
Main Crop:					
Tinwald Perfection	(I)	11.25	9.625	12.45	5
Kerr's Pink	(I)	14.05	11.787	13.85	5
Majestic	(I)	11.325	11.65	13.175	4
Bishop	(I)	9.3	9.337	10.087	3
Irish Chieftain	(I)	9.0	6.937	7.725	2
Rhoderick Dhu	(I)	5.6	5.5	9.55	2
Crusader	(I)	6.3	6.7	5.575	2
King Edward	(S)	9.15	[illegible]	9.5	2
Arran Chief	(S)	9.15	8.3	11.1	2
Up-to-Date	(S)	12.95	7.7	11.3	2

Immune varieties (I); susceptible varieties (S).

W. S. G.

839. **Edible Canna in Hawaii.**

CHUNG, H. L. and RIPPERTON, J. C. *Hawaii Agricultural Experiment Station Bulletin No.* 54, pp. 16, figs. 7. Washington, 1924.

The edible canna (*Canna edulis*) is indigenous to South America; the roots are cooked as a vegetable, but in Australia the plant is grown chiefly for starch.

Under Hawaiian conditions the edible canna can be grown at any season of the year; the maximum yield is produced at altitudes below 1500 feet. The crop is suitable for long or short rotation periods; the soil should be loose, loamy and well-drained. The plant is free from injurious insect attack, and from disease; the average yield is 18 to 20 tons of tubers per acre. The tubers have excellent keeping qualities.

The feeding qualities of both tubers and tops compare favourably with that of other starch and forage crops.

Canna starch has exceptionally large grains, morphologically similar to the potato; the viscosity is greater than that of maize starch but less than that of the potato. The cost of manufacture of the starch is low owing to the ease with which the starch separates.

The article gives details respecting climatic and soil requirements and methods of cultivation. W. S. G.

840. **The Time of Harvesting Soybeans for Hay and Seed.**

WILLARD C. J. *Journal of the American Society of Agronomy*. Vol. 17 No. 3. pp. 157-168, tables 3. Geneva, N. Y. 1925.

The yields of soybeans at different periods of maturity were obtained by harvesting at intervals of one week, eight uniformly distributed 16 foot rows of soybeans, grown on a uniform piece of land.

The greatest dry weight yield at one cutting is given when one-fourth of the leaves appear yellow, but cutting for hay at this stage causes difficulty in curing. The maximum green weight is given one or two weeks earlier.

The weight of leaves increases until the beans are well formed, remains constant for about three weeks, and then decreases. When the beans are well formed, the hay contains about 60 % leaves and 50 % when the beans are half grown.

The weight of stems reaches a maximum when the beans are well formed and then remains constant. The percentage of stems in the hay decreases until half leaves have dropped and then increases.

The yield of seed increases slowly at first, then very rapidly for one or two weeks, then more slowly until maturity. About 40 % of the mature crop is seed.

Soybeans should be cut for hay from the time the beans are well formed until the beans are half grown.

These conclusions apply to the varieties Manchu, Midwest, Ito San and Mammoth. W. S. G.

841. **The Belhambra (*Phytolacca dioica*) as a Fodder Plant.**

WALTERS, J. A. T. *Rhodesia Agricultural Journal*, Vol. XXII, No. 2. pp. 259-260, plates 2. Salisbury, Rhodesia, 1925.

The tree grows freely in Southern Rhodesia and produces seed abundantly. The plants can be grown easily from seed and when about 6 inches high should be transplanted to permanent sites. The growth

is rapid and plants should be spaced about 20 feet apart, to allow for growth of a spreading crown and corresponding root system. The branches will grow 12 feet in a single season.

Cattle will eat the stems of the tree when cut down ; the best method is to prune a few branches every day. The leaves form a good green food for poultry.

The belhambra provides a course of succulent food during dry months, and the nutritive ratio compares favorably with that of lucerne or green barley.

W. S. G.

Tropical and Sub-Tropical Industrial Plants.

842. **Plant Textile Fibres produced in the British Empire.**

WARD, J. S. M. *Journal of the Textile Institute*, vol. XVI, No. 1, pp. [illegible] Manchester, 1925.

The article discusses, mainly from the economic standpoint, the production within the British Empire of : cotton, flax, jute, sisal (*Agave sisalana*), New Zealand hemp (*Phormium tenax*), sunn hemp (*Crotalaria juncea*), Deccan hemp (*Hibiscus cannabinus*), Mauritius hemp (*Furcraea gigantea*), kapok, and ramie.

W. S. G.

843. **Inheritance and Inter-relationahip of the Principal Characters of the Flax Plant.**

DAVIN, A. G. and SEARLE, G. O. *Journal of the Textile Institute*, Vol. XVI, No. 3, pp. 61-82, figs. 8, tables 28. Manchester, 1925.

The article gives details and results of four years' research on the more important characters of the flax plant, from the point of view of fibre yield. The discussion is based for the most part on correlation data. It is shown that variations in flower colour, length of unbranched part of stem, percentage of fibre as measured by area in the cross-section of the stem, and the relative earliness of flowering, are all strongly inherited.

Other characteristics were studied and their inter-relationship investigated : these include number of capsules, number of seeds, thickness of stem, tillering, area of cross-section of stem, number and size of ultimate fibres, and number of fibres per square millimetre of stem area.

The differences between the nature and arrangement of various fibre bundles is clearly shown by excellent photomicrographic illustrations.

W. S. G.

844. **Cotton Grading.**

A. Grading of Cotton in the Sudan. *Empire Cotton Growing Review*, Vol. II, No 2, pp. 117. London, 1925. B. Cotton Grading in South Africa. [illegible] T. G. (Government Cotton Grader). *Ibidem* pp. 117-[illegible]. C. Cotton Grading in Queensland. EVANS G. (C. I. E.). (Director of Cotton Culture) and [illegible] (Government Cotton Classer). *Ibidem*, pp. 121-128.

The article gives particulars respecting the schemes [illegible] grading in force in the Sudan, South Africa and Queensland. In the case of

Queensland full details are supplied, including the schedule of grades and guarantees finally adopted for the 1924-1925 crop. W. S. G.

845 Improvement of Queensland Cotton Seed.

EVANS, G. (Director of Cotton Culture). *Queensland Agricultural Journal*, Vol. XXIII, Part. 3, pp. 183-184. Brisbane, 1925.

The cotton seed of Queensland is at present of mixed origin, but measures are being taken to place the industry on a more satisfactory basis.

The Department of Agriculture in 1920 decided to import seed of the Durango variety from the United States ; this variety is of Mexican origin, where it is cultivated under dry conditions not unlike those of Queensland. There are now about 6000 acres under this variety and it is anticipated that in 1926 there will be sufficient Durango seed for Queensland requirements.

The quality of the lint is satisfactory and the average staple length is 1 3/16 in., a length which is in great demand.

The following varieties are being studied by the Department : Acala, Lone Star and Webber 49. W. S. G.

846. The Effect of Water on the Cotton Plant.

PRESCOTT, J. A. *Sultanic Agricultural Society, Bulletin* No. 14, pp. 63, figs. 20, Cairo, 1924.

The bulletin records in detail the results of an experiment carried out at Bahtim on the irrigation of cotton, with special reference to the effect of varying amounts of water on the plants. It was found that conditions favourable to vegetative growth such as abundant water supply, suitable temperature and abundant plant food, resulted in delayed flowering and eventually in a smaller yield.

Large excess of water causes variations in the normal curve, which appear to be due to shedding. W. S. G.

847 Cotton Growing in Relation to Climate in Egypt and the Sudan.

WILLIAMS, C. S. *Ministry of Agriculture, Egypt*, Bulletin No. 47, pp. 31, graphs 9. Cairo, 1924.

The report is a summary of climatic conditions in relation to cotton growing in Egypt and the Sudan and is meant chiefly as a basis for further work.

The greatest similarity of rainfall and temperature conditions in Egypt and the Sudan is found about a month before the picking of cotton begins.

Owing to the difference in the cotton season, the conditions of growth are similar and the growing cotton escapes the very hot weather in the Sudan and the winter in Egypt. The cotton actually matures at a lower temperature in the Sudan than in Egypt.

Relative humidity and evaporation vary greatly in different localities

Cotton in the Sudan is probably grown with less daylight (sunrise to sunset) than in any other country as it is a winter crop farther away from the equator than any other winter grown cotton. W. S. G.

848. **Ratoon Cotton in Egypt.**

TEMPLETON, J. *Ministry of Agriculture, Egypt (Botanical Section), Bulletin No. 55*, pp. 14, graph, bibl. Cairo, 1925.

The author mentions that the cotton plant was first cultivated in Egypt about 1821 and was grown as a perennial; also that it was on account of Government action alone that the perennial method of cultivation disappeared from Egypt.

The results of a preliminary experiment indicate that:

(1) Ratooned Plants (var. Sakellarides) in their second year give a higher yield that in the first;

(2) the quality of the second year's lint is not inferior to that of the first year;

(3) the crop matures much earlier in the second year;

(4) loss from boll-worm attack is less the second year;

(5) shedding of bolls, in proportion to flowers, is less in the second year. W. S. G.

849. **Cotton Growing in Madras.**

BARBER, Dr. C. A. (C. I. E.). *Empire Cotton Growing Review*. Vol. II, No. 2, pp. 100-107, 1 map. London, 1925.

The cotton area in the Madras Presidency extends from 8° to 16° north latitude, the area being broken up by two mountain ranges.

The indigenous cotton varieties are entirely rain-fed, the annual fall varying from 20 to 40 inches, the greater part falling from May to November, the remainder of the year often being quite dry. The growing period is in consequence limited, and the crop is only able to mature because of the peculiar qualities of the « black cotton soil », which covers large areas between the mountain ranges. This soil is very uniform in texture and is remarkably retentive of moisture.

The indigenous Indian cottons are deep rooting, and on this soil continue to grow and mature their bolls long after the last rains of the year have fallen.

In North India cotton is a summer crop, because of the winter cold, whereas in the south of Madras it is a winter crop; in the north of Madras a transition between the two extremes is met with. In the North, planting takes place in July and August, and in the South in October, in both cases picking begins in February, which in the South makes the growing period very short.

In Madras about 2,300,000 acres are under cotton each year. The species of cotton grown are, in the Western tract, *Gossypium herbaceum*, with a rather short, harsh lint of a pure white colour; in the Northern area *G. herbaceum* and *G. indicum*, with a lint less white in colour but longer and softer, in the Cocondas tract a new species is grown, G. [illegible]

folium, with soft lint often of a khaki colour, irregular in length and inferior in staple to the Northern. In the southern part of Madras are grown *G. herbaceum*, *G. indicum*, and a recently introduced American species, *G. hirsutum*.

The preparation of a perfect seed bed is carefully attended to and the land is well cultivated, but no manure is given to the cotton crop because rank growth would be induced, which would prevent the bolls ripening before the hot, early summer, when all immature flowers and bolls are quickly shed. Any manure supplied is given to a previous crop of the rotation.

Except in the case of poor farmers, a rotation is universally practised in Madras cotton cultivation, a crop such as millet being introduced. On the black cotton soil weeding is not a serious item, but the land is continuously worked over after the rains have ceased. Picking is done by women and children.

The marketing leaves much to be desired, although improvements are being introduced by the Agricultural Department. The poorer cultivators who constitute the bulk of the growers, are always more or less in the hands of middlemen and moneylenders, which makes very difficult the introduction of co-operative selling, the establishment of regular markets, or the formation of buyers' associations.

Selection work has been carried out for many years the result of which is that there is at the present time a grade of superior cotton on the market, known as "Tinnevelly American" or "Pure Karunganni". The length of the lint is $\frac{9}{10}$ to 1 inch, and the ginning percentage 25 to 26, as against $\frac{3}{4}$ to $\frac{7}{8}$ inch and 27 for ordinary Tinevellies. An American Uplands type has been introduced which requires occasional irrigation, as it lacks the deep-rooting system of indigenous Indian cotton; this is termed "Cambodia" cotton, and is grown in the southern part of Madras. The length of lint is a little over 1 inch, the ginning percentage 33, and the market price obtained is equal to, or slightly higher than ordinary Uplands cotton.

W. S. G.

850. **The "Babassù".**

TEXEIRA DA FONSECA E. O Babassu (*Attalea speciosa* Mart., *Orbignia Martina* Barb. Rodr.) *Ministerio de Agricultura, Industria e Commercio, Serviço de Informações*, 45 pp. figs. & bibliography. Rio de Janeiro, 1924.

Before the war, the exportation figures for palm-nuts (including "petits-cocos", "piassava" and "babassu") were as follows:

Year	Kg	Value in reis	Value in sterling
1910	550 712	66:086	38 326
1911	394 728	47:368	28 019
1912	76 002	9:120	5 403
1913	485 019	58:202	34 490
1914	796 118	13:609	62 790

[850]

The following were the export figures under the head " coquilhos di piassava ":

Year	Kg.	Value in reis
1915	4 323 617	938:843
1916	2 560 516	878:783
1917	2 628 074	1 590:800

whereas, in the years following, the two products were kept distinct in the export statistics, as follows:

Year	Kg.	Value in reis
1918	6 103 773	4 320:938
1919	11 003 658	7 796:510
1920	6 581 944	4 598:832
1921	7282 885	4 688:007
1922	21 958 288	15 991:536

Piassava nuts

1918	205 633	82:016
1919	32 184	19:531
1920	90 070	12:312
1921	71 658	13:931
1922	728 285	206:097

Common names: These vary according to the different districts; in the Pianhy " coco de macaco ", in the interior of Bahia " coco de palmeira ", and near the Capital, " coco de rosario ", because the kernel is sold threaded in rings, in the Matto Grosso, " aguacù ", " auaçù ", " guaçu ", " baguaçu ", " guaguaçù ", which names are a corruption of " uauaçù " or " oanaçù " of the Amazons, which are the true native names (formed from ua — fruit, and acu — great, owing to the largeness of the fruit), " buassu " and " babassu " in Maranhâo.

Botanical classification: MARTIUS calls this tree *Attalea speciosa* and says it comes from Equatorial and Eastern Brazil, where it is called " uauassù " *propter fructos magnos*. PECKOLT gives it the same name, whereas in the Botanical Garden at Rio de Janeiro these specimens bear the name *Orbignia speciosa* Barb. R. In the publications (1917) of the Imperial Institute of London, the babassù is sometimes called *Attalea* [illegible] sometimes *Attalea funifera*: but under this latter name the " piassava " of Bahia is indicated. BARBOSA RODRIGUEZ says that the gen. *Attalea* of MARTIUS is an *Orbignia*, and has therefore changed its denomination into *Orbignia Martiana*. DRUDE calles this plant [illegible]

Geographical distribution: This palm is found diffused over all the region of the Amazons from the Matto Grosso to Bolivia, including Maranhâo, Pianhy, Rio Grande do Norte, Parahyba, Pernambuco, Goyaz, [illegible] its presence has been noted at Minas Geraes.

Products and by-products: The trunk is used as a support, and when it rots, forms an excellent fertiliser; the new leaves are used to cover huts, and to make walls and also hedges; when dried they are used for making hats, nets, purses and baskets for carrying grain, the small ones, cut into narrow strips, serve for panniers and baskets; the tree, while still young, has a large and aromatic trunk; the succulent substance of the mesocarp of a violet-white colour, rich in starch and tannin, is used as a food, after having been dried and washed, in the form of manioc flour. From this an oil is extracted similar to that of the "dende" (*Elaeis guineenses*).

The dark brown, horny, endocarp serves for making buttons.

According to the author the palm produces from 2 to 6 bunches of 2 and more m. in height and of varying weight; the large ones with 500-600 nuts, the medium with 300-400, and the small with 200. Dr. A. DE ANDRADE says that the bunches weigh so heavy that two men can scarcely lift one; 5 bunches examined by the learned Doctor bore respectively 580, 442, 361, 217 and 161 fruits.

As to the size of the fruits, some are 10-12 cm. in length and 6-8 in width, weighing 140-250 grams.

The following are the results of an analysis of the dried edible kernel made by Dr. ANDRADE:

water	13.200
fat	66.750
proteins	2.612
amino-acids, non-protein nitrogenous substances	0.875
saccharose and other carbohydrates	13.263
cellulose (fibre)	2.500
fixed mineral salts	0.780

The % of oil from hydraulic pressure was 69 % i. e. 690 gms., oil per 1000 gms. kernels.

An analysis made in London gave the following results:

water	4.21
oil	66.12
albumenoids	7.18
carbohydrates	14.47
mineral matter	2.02
fibre	5.99

The author then examines the various methods for extracting the oil, which is used for the manufacture of soap and perfumes, for lubrication and for the kitchen, etc. It is clear, unctuous and slightly yellow; solidifies at 20-22°C.; density 0.914. It makes an excellent fuel for motors of the Diesel and semi-Diesel type, superior to crude oil and the best petrol.

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The following are the results of various analyses.

I — Analysis by the Imperial Institute, London:

melting point (in open tube)	26°C.
solidification point of the fatty acids	23°C.
specific weight at 15°C.	0.868
acidity index	5.5
saponification index	249
iodine index	15.6
non-saponifying substances	0.3%
soluble volatile acids	5.8
insoluble volatile acids	10.2

II — Analysis by R. BOLTON and D. HEVER (indication as *Attalea funifera*):

weight of 100 fruits	11.200 gm.
% of oil in the kernel	65.7
melting point	22.2° C.
complete fusion point.	26.1° C.
solidification point	22.7°
saponification index.	246.9

III — Analysis by Dr. BRITO PASSOS:

initial melting point:	72°F.
melting point:	79°F.
solidification point	72°F.
saponification value.	247.7
iodine index.	16.83
free fatty acids	1.98
refraction index (Zeiss scale at 40°C.)	36.9
glycerine.	13.2 %

There are many differences among these analyses, thus rendering necessary new and more exact researches.

The following are two analyses of babassú copra and Bahia coconut copra, which show the superiority of the former:

	Babassú	Bahia coconut
moisture	4.21	3.80
oil	66.12	66.00
albumenoids	7.18	7.27
digestible carbohydrates	14.47	15.95
woody fibre	5.99	4.55
mineral matter	2.03	2.43
	100.00	100.00

The oil cake is very rich in food substances, especially albumenoids and carbohydrates, as is shown by the following figures :

water	15.59
oil	6.50
albumenoids	19.81
assimilable carbohydrates	4.00
fibre	16.50
mineral matter	5.60

Other by-products obtained by distillation from the "babassu" coconut are : superior metallurgic coke, tar, calcium acetate, and methyl alcohol.

It produces cocoa and vegetaline or butter, superior to that from milk The refuse forms an excellent fuel, which may be used for locomotives. The fibre is excellent for making cordage and ropes, and offers great resistence to sea-water.

Number of the trees : This is not easy to determine because in the statistics no distinction is made between coconut and other palms. The number (of the former) must be immense — several millions, the more so as those which are exploited are an insignificant part of the total number.

In a publication on the Principal Agricultural Products in Brazil in 1922-23, the production of "babassù" in 8 States (13 Municipalities) is given as 45 million kg., which at 600 reis per kg. = 27,000,000,000 reis. or Fcs. 86,557,500. According to the same work, the State of Maranhão from 1921 to 1923 produced 833,000 kg. of "babassù" kernels, and for 1923-24 its production was estimated at 2,260,000 kg. F. C.

851. **Variation in Coconuts with reference to Fruit Production.**

JACK, H. W. *The Malayan Agricultural Journal*, Vol. XIII, No 2, pp 25, bibliography. Kuala Lumpur, 1925.

The selection of seed coconuts is of the greatest importance owing to the length of the profitable life of the palms, which under good conditions should exceed fifty years.

The wide variation in several characters of the palm is well known, but there is little statistical proof as to the degree of variation. These differences have been noted in the case of : number of roots per palm, number of female flowers per spathe, number of spathes, oil content of the meat, and in number shape, size and weight of fruits.

The author found that, despite environmental factors each tree will retain its own individuality as long as conditions favour a fair degree of development, and that good producing trees remain good yielders on the average, and poor yielders continue to give a low yield. The data given show definititely that there is a wide range of variation in fruit production per palm, and indicate that this is not due to soil variations.

The frequency curves show the variation in production graphically, and demonstrate the need for selection in this important branch of tropical agriculture. W. S. G.

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852. Resins and Oleo-Resins of Indo-China.

CREVOST Ch. Résines et oléoresines de l'Indochine. *Bulletin économique de l'Indo-Chine*. Year XVIII, No 170, pp. 1-57, numerous plates, 1925.

The *Bulletin économique de l'Indo-Chine* continues the publication of the *Catalogue of the Products of Indo-China*, which in the form of an abstract, constitutes an independent work of great documentary importance. The three first volumes of CREVOST and LEMARIE being completed, Mr. CREVOST, since the death of the latter, continues the publication alone.

The first part of Volume IV has been given in the *Bulletin Économique*, that is to say, class XVII "Resins and Oleo-resins".

The author studies successively the following products:

A, *Resins.*

I. Dipterocarp-resins.

(1) Damars of Batavia: *Hopea odorata* Roxb., *H. Thorelli* Pierre, *H. dealbata* Hance, H. *Pierrei* Hance, H. *Recopei* Pierre, *H. ferrea* Pierre.

(2) Secondary resins: *Shorea vulgaris* Pierre, Sh. *Thorelli* Pierre, *Sh. obtusa* Wall., *Sh. Harmandii* Pierre, *Sh. hypochra* Hance, *Sh. Cochinchinensis* Pierre, *Sh. Henryana* Pierre, *Sh. maritima* Pierre, *Sh. cambodiana* Pierre, *Pentacme siamensis* Kurr. (=*Shorea siamensis* Miq.).

(3) Vatica Resins: *Vatica philastreana* Pierre, *V. Thorelli* Pierre, *V. harmandiana* Pierre, *V. astrotricha* Hance, *V. faginea* Dyer., *V. Dyera* Keng., *V. tonkinensis* A. Chev.

(4) Copals: *Anisoptera robusta* Pierre, *A. cochinchinensis* Pierre, *A. glabra* Kurz., *A.* sp.

II. Coniferous Resins, buds of *Pinus* spp.

III. Burseracees Resins, "elemi" of *Canarium copalijorum* A. Chev., black damar of *C. nigrum* Engl.

IV. Hamamalidagees Resins, of *Liquidambar tonkinensis* A. Chev., *L. Orientalis* Mill., *Altingia excelsea* Nor.

V. Leguminous resins, of *Sindora cochinchinensis* H. Baill.

VI. Hypericaceous resins of *Cratoxylon prunifolium* Dyer.

VII. Simaburaceous resins, *Ailantus malabarica* D. C., *A. fauveliana* Pierre.

VIII. Urticaceous Resins, *Strebius asper* Lour.

The direct exportation of Indo-Chinese resinous products is very small, but it must be borne in mind that the greater part of these products, such as the fine damars of Cambodia and Laos, pass through Siam for export, principally to Singapore, a large market for resinous products. The following figures show the importance of this market.

Trade of Singapore from 1900 to 1920.

(A) Copals:

Imports: 120,000 tons, valued at $ 26,500,000 or $ 221 per ton.

Exports: 144,000 tons, valued at $ 38,000,000 or $ 250 per ton or a value of exports over imports of $ 12,500,000.

(B) Damars :

Imports : 96,000 tons, valued at $ 10,900,000 or $ 112.50 per ton.

Exports : 86,400 tons, valued at 11,700,000 or $ 135 per ton or a value of imports over exports of $ 800,000.

B = Oleo Resins (wood oils).

Supplied by *Dipterocarpus alatus* Roxb., *Dipterocarpus tuberculatus Roxb.*, *D. intricatus* Dyer, *D. Jourdaiini*, *D. artocarpifolius* Pierre, *D. Dyeri* Pierre, D. *Duperreanus* Pierre, *D. insularis* Hance, *D. obtusifolius* Teysm. *D. punctulatus* Pierre, *D. tonkinensis* A. Chev. *D.* spp.

The wood oils produced by these Dipterocarps are used almost entirely for local purposes,

Laboratory tests have shown that their distillation gives a large percentage of essential oil, average 65 %, which could undoubtedly be used in the preparation of paints when mixed with linseed-oil.

The author places the exudation of the *Calophyllum inophyllim* Lin. of the Guttifer family in the same class as these resinous products.

P. C.

853. **The Beet Crop in Czechoslovakia in 1924.**

URBAN, J. (Forschungs-Institut der tchsl. Zuckerindustrie). Das Wachstum der Rübe in Jahre 1924. *Zeitschrift für die Zuckerindustrie der Tchechoslowakischen Republik*, Vol. XLIX, No. 25, pp. 187-193, 2 diagrams. Prague, 1925.

The author compares the crop of beet in 1924 with that of 1923, taking into account all the elements of the beet (weight of leaves, roots, sugar content, etc.) as well as the weather conditions. Up to the month of September no differences were noticed between the two years ; afterwards the growth increased in 1924, owing to more abundant rain. The total rainfall was in fact 378.5 mm. in 1924 from the 1st April to the 29th September against 302.4 in 1925. Consequently the average weight of the beetroot up to the 29th September was increased from 729 to 837 gm. On the contrary the sugar content decreased from 18.77 to 17.23 %, improving however in the following month of October in which fine weather was favourable to assimilation. An evident increase also took place in the foliage. On the whole, it resulted that in the last two weeks, the weight of root was 14.2 % higher in 1924 and the amount of sugar in each root was 6.44 % greater than in 1923. These two figures therefore show an increased crop per hectare.

A. F.

854. **Coffee Planting in Tanganyiks Territory.**

FOSCANER, J. *The Spice Mill*, Vol. XLVIII, No. 1, pp. 22-27. New York, 1925.

The author's article indicates that in a few years the Arusha district of Tanganyika Territory will become a good coffee-producing area.

The Arusha district is situated on the slopes of Mount Meru, at an elevation of 3000 to 5000 feet. The climate is excellent ; the long rains

occur from March to May, and the short rains in September, the total precipitation being about 55 inches. The soil is exceedingly fertile, and water abundant.

The first coffee seed came from Bourbon and Java. Bushes are planted 8-9 feet apart.

A report on a sample of coffee from the district states that it can be placed in the same class as the washed, hard bean of Costa Rica and Guatemala, and that the liquor has good body and flavour.

W. S. G.

855. Tea in Ceylon.

HARLER C. R. *Journal of the Indian Tea Association*, Part IV, pp. 193-226, Year 1924. Calcutta, 1925.

The author gives an interesting and instructive account of tea-planting in Ceylon, and treats the subject under the following heads:

Statisticas, climate, soils, planting, pruning, plucking, manuring, cultivation, pests and diseases, manufacturing process.

The article concludes with a comparison of India, Ceylon, and Japan teas.

W. S. G.

856. The Effect of Distancing on Tobacco Leaf.

IMATONG S. B. *Philippine Agriculturist*, Vol. XIII, N° 7, pp [illegible], figs. 5, bibliography. Los Baños, Laguna, 1924.

The author found from his investigations that the different varieties of tobacco seem to require different distancing. The height of the plant is affected by the distance of planting. The size of the leaf is also affected; when planted 40 × 40 cm. and 40 × 50 cm. many small leaves were produced, but when spaced 50 × 75 cm. or 100 × 100 cm. the leaves were larger. The greatest weight in kilograms of lower standard and top leaves per hectare were obtained by close planting, but the size of leaves obtained by close planting was much reduced.

The burning quality of the leaves was improved by close planting, due perhaps to the leaves being thin and small veined, whereas wide spaced plants yielded leaves with coarse veins and a gummy tecture, which had poor burning quality.

W. S. G.

Arboriculture and Forestry.

857. Fruit Growing in British Columbia.

DYMOND T. S. *Agricultural Progress*, Vol. II, pp. 48-5[illegible] London, [illegible]

Eighty per cent. of the orchard fruit in British Columbia is produced in the Okanagan Valley, where 20 000 acres of orchard are under cultivation. The valley is situated 150 miles from the Pacific coast at an altitude of 200 feet, in the dry belt, the rainfall being below 14 [illegible] and irrigation is necessary. In the valley is the Okanagan Lake, [illegible] in length, on the shores of which the temperature rarely falls below [illegible] F. or rises above 90° F.

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The chief centre is Kalowna, about halfway down the lake, situated on an alluvial flat ; a series of benches, the alluvial flats of former lake levels rise behind the town ; these flats are covered with orchards of apples, pears, peaches, plums, apricots and cherries.

The soil is ideal for fruit culture ; ploughing in of vetches seems to be the only form of manuring required. The limiting factor is the water supply, and no more land can be brought under cultivation without fresh expenditure on irrigation works, which present fruit prices would not justify.

The fruit is mostly consumed in the prairie cities, while some is exported from Vancouver and through the Panama Canal to England.

The Federal Government gives grants in aid of farm costings and supports an experimental station, where experiments are carried out on matters of direct importance to fruit growers. A staff of horticultural, entomological and other experts give lectures and pay advisory visits. The University Agricultural Department gives courses of instruction at Vancouver.

As regards settlers : the Okanagan Valley is no longer open for the man without capital, as all the land than can, for the present, be irrigated is already developed. W. S. G.

858. Investigations on Apples with Special Reference to Cider Apples.

I. — CHEVALIER, A. (Chef de la Mission permanente d'agriculture au Ministère des Colonies). Recherches biologiques sur les Pommiers et spécialement sur les pommiers à cidre. *Revue de Botanique appliquée et d'agriculture coloniale*, Vol. 1, No. 3, pp. 149-115. Paris, 1921.

II. — SOURDIN. Composition des vergers des principales régions cidricoles. *Comptes rendus des travaux de la semaine nationale du cidre*. Paris, May 1925, pp. 83-90.

LIÈVRE A. L'élevage rationnel du Pommier. *do*. Paris, 1924, pp. 24-32.

LECŒUR. La création et l'entretien des Vergers. *do*., pp. 32-43.

III. — BIJHOUVER J. (Laboratorium voor Plantenphysiologische Onderzoek). The Periodicity of the Development of the Bud on the Apple-tree. De Periodiciteit van ve Knopontwikkeling bij den Appel. *Mededeelingen van de Landbouwhoogeschool*, Vol. 27, No. 7, p. 63, fig. 10, 3 diagrams. Wageningen, 1924.

IV. — MANARESI A. and G. B. GARAGNANI. (R. Istituto Agrario Superiore di Bologna). The Floral Biology of the Apple. Ricerche sulla biologia florale del melo. *Le Stazioni Sperimentali agrarie italiane*, Vol. LVIII, Part 1 to 6, pp. 18-124, 62 tables, 5 plates, bibliography. Modena, 1925.

I. Normandy is at the present time the most important apple growing district in the whole world ; the crop is devoted almost exclusively to cider making in France. Three Departments use the entire crop for the well known drink and during the years when the yield was exceptionally high (e. g. 1895), as much as 25 600 000 hectolitres of cider was produced. During the last 30 years, the greatest progress as regards apple growing has been made in the United States and in Canada. To France is due,

however, the credit of having been one of the first countries, to undertake a methodical study of improved fruit growing. At Rouen the first really scientific studies were made on the cider-press fruits and as far back as 1836 by the "Société d'Horticulture de la Seine-Inférieure".

The author with reference to the information supplied by the abbé ROSIER and A. LEBAULT states that the cider industry has made rapid strides in France since the end of the XI century and it is evident therefore that the cultivation of the cider apple did not originate from wild stock. In fact it is very obvious that the cultivated trees in the north-west of France differ considerably from the wild *Malus silvestris* found in the forests in the same region. The cider apples and dessert apples both belong to the *Malus domestica* groups and both may be traced as descended chiefly from *Malus dasyphylla* native of Western Asia.

All the cider apples in Normandy differ widely from the bitter fruits in the forests and the author is convinced that they originate from another region, namely the Biscay coastal area, in Northern Spain; where large numbers are still to be found.

The author has made a list of varieties and strains of *Malus* found growing wild in various parts of the world; he enumerates 32, drawing attention however to the fact that the term "species" is very loosely used in the case of apples.

The dying out of former varieties especially in Normandy, is admitted by the majority of fruit growers; propagation by grafting does not always give characteristic stock, and eventually variations in shoots occur which alter considerably the original variety. In addition to this, grafting may give rise to fairly distinct modifications, especially when the stock and scion are unsuitable. For this reason it is essential that the superior varieties be renovated or seed obtained; selection is consequently necessary if the variety better adapted for cider purposes is to be maintained.

Considerable progress has been made as the result of cross-fertilisation tests by KNIGHT in England and V. MACOUN in Canada.

The author supports the conclusions arrived at by NAITE as to the important part played by insects in cross-fertilisation of apples and pears.

Parthenocarpic varieties of apples are to be found.

With certain dessert varieties this is incomplete. In Russia and Norway certain varieties (Russian) grow satisfactorily as far north as 66°; in Canada not beyond 55°. In warm countries less success has been obtained; this may be attributed to the fact that attempts have been made to introduce superior cultivated varieties into Europe, when it would have been better to experiment with wild varieties already cultivated in the Mediterranean coast and in subtropical Asia.

The acclimatisation of apple trees to tropical countries is however, according to the author, not hopeless and it is suggested that microcarpic apples be introduced from China and Japan and crossed with common varieties and the hybrid obtained recrossed with the wild varieties in Indo-China (*M. laosensis* and *M. Doumeri*). In this way good results might be obtained.

In the list of species given the author includes [illegible]

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particular. *M. bangalensis* Hook F., found occasionally at 1000 m. altitude; several Photinia in Indo-China, e. g. *P. Benthamiana* Maxim., found on the Annamite ridge at 1000 to 1500 m.; *Sorbus* spp. e. g. *Aria*, *Cucuparia*, *Micromeles*, in India, Yunnam and doubtless also on the unexplored mountains of Tonkin; the *Docynia*, the *Raphiolepis indica* Sindl., found in Cambodia at 600 m.; the Strauvraesin and Pourchanea of China; the *Amelanchiei* of America. If for example one or more of these species can be utilised as stock for grafting apples and if success is forthcoming in the tropical plains, the problem of acclimatisation will be well on the way to solution.

The following conclusions have been drawn by the author:

There is still much to be discovered as regards the biological peculiarities of fruit trees and especially cider apples, which are so abundant in Normandy and the surrounding provinces; until now cultivation and improvement have been undertaken only by unscientific methods.

The satisfactory results obtained, however, by investigators, suggests that considerable improvement may be possible both as regards selection and cultivation. To obtain a good crop, certain biological characteristics, brought to the fore during this work should be noted, and the conditions required to obtain better varieties.

The method of cultivation of fruit trees in the different cider provinces of France has been extraordinarily neglected. After reading the "Cahiers du Sire Gillies de Gonherville" it is surprising to learn that a simple country gentleman even as long ago as 1560 gave the greatest care to the raising of his apple trees and the manufacture of cider which was up to the standard of the present day Norman growers with their orchards and cellars.

When adequate attention is given to careful cultivation, and to the substitution of unsatisfactory varieties by good croppers, the cider industry will add considerably to its value and importance.

II. The essential qualities to be looked for in cider apples relate both to the tree and the fruit. As regards the tree the first requisite is fertility: as there is no variety that is equally fertile all the time, it is necessary in order to estimate production to take it over a period of at least ten years. An apple-tree may be considered as fertile which bears on an average, yearly, the third part of a full crop, i. e. a hectolitre and a half of apples. Among other qualities are vigour, to be recognized by the thickness and and the colouring of the foliage, hardiness, by which is understood resistance to atmospheric influences, attacks of insects and parasitic diseases, and adaptability to the soil; a closer study is necessary to establish practical conclusions as to this last point.

As regards the fruit, preference has to be given to varieties which have a good appearance for the market and which stand transport well; the juice should be easy to extract and should contain the right proportion of sugar, of acid and of pectic substances and generally the constituents favourable to the production of a wholesome cider

There are at the present time about 100,000 varieties of apple-trees.

Among these a twentieth will be selected of which two twentieths should have acid fruits, six-twentieths of bitter fruit and twelve-twentieths of sweet fruit. So as to facilitate mixing, varieties will be cultivated which ripen at different seasons, selecting three-twentieths of trees in their first fruiting, seven-twentieths of those in their second and ten-twentieths in their third.

It is obvious that the varities must be adapted to the different soils and countries.

The most suitable soils are the flint clay soils, the least suitable the lime soils. Granite soils are excellent: and in soils containing potash large and well-developed fruit is obtained, which give a first rate cider.

Propagation is by seed, followed by grafting on the foot or better on the foot and at the top.

Of the utmost importance is scientific manuring which secures a regular crop. A full grown tree requires the following fertilisers for every square metre of the area covered by its roots:

Nitrogen 17 gm.; phosphoric anhydride 5 gm.; potash 22 gm.; lime 40 gm.

It should be taken into account that each apple tree produces annually 8 kg. of wood, 15 of leaves and 100 of fruit: hence the necessity for providing a sufficient quantity of material in the form of chemical fertiliser, road scrapings, calcareous marl, calcium carbonate, and decomposed stable-manure.

As regards growing crops on the soil under the trees, it should be noted that this should not be done during the first ten years of the life of the tree. Later on the trees become less sensitive to drying of the soil and accordingly it is possible to allow grass to grow under them or to cultivate wheat or oats.

Special attention should be paid to the trunk and main branches, with should be cleaned every threeye ars by thorough scraping and removing all the old corky bark which shelters insect pests. The bark so stripped off should be burnt. The growths of lichens and mosses, which are often noticeable in damp climates, should be treated with sulphur, iron or lysol.

III. It is usually reckoned that three years must elapse from the appearance of the bud to that of the fruit-bearing, and during that time the "vigour" of the bud goes on increasing. It remains however to be seen whether this vigour consists rather in the number or in the size of the parts and whether there is any real connection between the vigour and these two characters.

The author has been able to ascertain that during the summer months a certain correlation exists, at that time most evident, between the vigour and the dimensions of the small bracts that surround the bud. The growth in length of the bud stops towards the middle of August, equally with the growth on length of the larger leaves. It may be recalled that among the ten bracteolar formations of the bud in existence in April, at least five have been formed in the June to August period of the previous year.

The growth and the primary formation of organs in the leaf and floral bud of the primary axis ceases by the middle of summer, while in the secondary axes they continue till the beginning of the cold weather.

IV. From the continued investigations carried on through six succeeding years on different varieties of apple trees it appears that the flower-bearing buds — or rather those bearing both leaves and flowers — begin to swell towards the second half of March and the first days of April and thus disclose the actual flower-buds, which then come out in April. The actual dates depend on the season, the variety of tree, the position of the buds on the branch, etc.

The time which elapses between the visibility of the petals and the complete unfolding of the flower is in favourable seasons from 10 to 11 days. For the unfolding of all the flowers of a single inflorescence two to six days is usually necessary. The blossoming takes place nearly always in the daylight hours and is at its maximum at midday.

The anthers discharge the pollen one day after the opening of the flower, sometimes also several days after, up to seven: for the most part it takes one to two days for all the anthers in one flower to open. The dehiscence takes place as a rule in the day time and requires from half an hour to some hours for each anther. Rain puts a stop to dehiscence: the pollen sacs after being soaked for some hours close up and thus shelter the grains which they still contain.

The shedding of the pollen follows immediately on the dehiscence of the anthers and in favourable conditions takes less than half an hour, with resulting impollination of the stigmas, carried out by insects, bees, bumble-bees, etc. which however also visit the unopened flowers and those with closed anthers.

The stigmas of flowers which have been open a few hours or are half opened, always seem on examination under the microscope to be very well impollinated: the pollen grains are scanty only in very windy weather or on very cold cloudy or partly cloudy days even when there is no wind. The pollen is caught and held not by the so-called "stigmatic liquid" which the authors have not been able to trace, but by adherence to the numerous papillae of the stigma which aid the germination.

One or two days after the blossoming and sooner in the case of wet weather, the stigma becomes brown from necrosis of the cells: three to six days after the petals fall, the process being hastened by strong winds, or prolonged rain and delayed by calm or cold weather and marked humidity.

As regards the setting of the fruit the authors, contrary to the usual opinion, have observed that fine days are not the most favourable, but on the contrary days that are partly fine and partly cloudy, with or without light rain, with an average temperature of from 10° to 12° C and a humidity of 45 to 75 %. On the other hand windy days are unfavourable and so are days that are partly fine but with a good deal of rain or a temperature below 8°C, or cloudy days with or without rain.

Apart from the season the flowers that first open have the best chance

of setting their fruit on account of the larger quantity of nutritive material available.

There is a very great difference between the number of the flowers that open and that of the fruits that set, inasmuch as very many flowers and many small fruits fall in the first period of their development. This "fall" is particularly noticeable in the second, third or fourth week after the opening of the flower and may continue till towards the sixth, and may be due to parasitic or to physiological causes. In spite of frequent and plentiful sprayings with insecticides, etc., much loss is due to the former cause. The flowers ar damaged by: *Anthonomus pomorum* (0.3 to 30.4 %), *Hyponomeuta malinellus* (0 to 8.5 %), *Phyllobius oblongus* (0.7 to 1 %), snails (0 to 11 %), larvae of *Sessia* sp. (0 to 1.9 %), larvae of a Geometrida (0 to 2.2 %). The small fruits fall as the result of: *Hoplocampa testudinea* (0. to 7.5 %), *Carpocapsa pomonella* (0 to 2.2 %), *Sphaeropsis malorum* (0 to 8.8 %) and up to 7.3 % fall as the result of causes not fully ascertained.

Much more serious is the falling from physiological causes, by which from 45.1 to 97.3 % of the flowers or the small fruits are lost and which is due to imperfect pollination, or to deficiency of carbohydrates, nitrogenous substances or water. The consequence is that only from 0.3 to 29.3 % of the flowers succeed in producing ripe fruit.

During the development of the fruits the styles and stamens still present dry up, the sepals rise and enclose the thalamus, the shape of the apple goes through various changes, pits form round the calyx and the peduncle, etc.

The final size attained by the fruits depends on various causes, the most important of which is the number of well-formed seeds which they contain.

A. F.

859. **American Stocks in Viticulture in South Africa.**

DU PLESSIS, A. M. *Journal of the Department of Agriculture*, Vol. X, No. 5, pp. 391-404, plates 8. Pretoria, 1925.

The author gives botanical descriptions and notes on the following hybrids tested in South Africa.

Riparia × *Rupestris* 101-14. The cuttings of this hybrid root and graft easily and give strong, fruitful, grafted vines. Gives good results on a variety of soils.

Riparia × *Rupestris* 3306. Strong grower on fertile soils. Cuttings root easily. Highly resistant to phylloxera.

Riparia × *Rupestris* 3309. Strong grower on fertile soils. Has given good results in fairly dry and heavy soils. Cuttings root and graft well. High resistance to phylloxera.

The above three hybrids are highly resistant to phylloxera; root and graft easily, and have good affinity for most vinifera varieties. They are among the very best stocks in use to-day.

Notes are given respecting the following hybrids, which however proved to be less successful or have not yet been fully tested: *Riparia*

× *Berlandieri* 420 A, *Riparia* × *Berlandieri* 34 E. M., *Riparia* × *Berlandieri* 157-11, *Riparia* × *Cordifolia* 125-1, *Riparia* × *Rupestris* × *Cordifolia* 106-8, *Riparia* × *Solonis* 1616, and *Jacquez*. W. S. G.

860. **Eucalyptus Species for Supply of Electric Power Transmission Poles.**

SIMMONDS, J. H. *New Zealand Journal of Agriculture*. Vol. XXX, N° 3, pp. 157-166. Wellington, 1925.

The author alludes to the suitability of various species of Eucalyptus for supplying transmission poles, and states the restrictive factor in the limitation of the range of this genus is temperature. Causes of former success s and failure of plantations in New Zealand are discussed.

Descriptions of many species are given and in order to assist the planter in selection of species for his particular district, the following table is given, the order being that of resistance to low temperatures :

Climatic conditions	Species
Winters with severe and prolonged frosts and heavy falls of snow.	*E. Gunnii*, *E. gigantea*, *E. Dalrympleana* (probably).
Winters with frequent severe frosts and occasional snow.	*E. viminalis*, *E. gigantea*.
Winters with many frosty nights usually followed by clear days.	*E. globulus* (seaboard), *E. Macarthuri* (inland), *E. Acervula*, *E. eugenioides*
Winters with mild frosts usually followed by clear days.	*E. eugenioides*, *E. saligna* *E. botryoides*, *E. hemiphloia*, *E. Muelleriana*, *E. sideroxylon*, *E. laevopinea* (probably), *E. Bosistoana* (probably), *E. pilularis*.
Winter without or almost without frost, with many hot days in summer.	*E. longifolia*, *E. corynocalys*, *E. crebra*, *E. paniculata*, *E. siderophloia*.

W. S. G.

LIVE STOCK AND STOCK BREEDING.

General.

861. **The Disinfection of Stables.**

POPE G. W. (Veterinarian, Field Inspection Division, Bureau of Animal Industry), *Farmer's Bulletin* N° 954. *U. S. Department of Agriculture*, 12 pp. 7 fig. Washington D. C. 1925.

After having shown the necessity for disinfection the author describes various disinfectants, indicating their method of use, bactericidal value, advantages and drawbacks. He examines successively bichloride of mercury, chloride of lime, chlorine gas, formaldehyde, pure carbolic acid

crude carbolic acid, creosol, solutions compounded with creosol. To insure thorough disinfection is required:

(1) A preparation of the building to be disinfected so as to facilitate contact of the disinfectant with the disease germs.

(2) A disinfectant appropriate to the germs to be killed.

(3) A method of application insuring the most intimate contact with the bacteria.

Explanatory figures show stables easy or difficult to disinfect and a series of disinfecting apparatus capable of giving good results.

P. D.

862. **Paralysis of Chickens due to Coccidiosis.**

LEYNEN, E. (Director of the laboratory of the veterinary Inspection) Paralysie des poussins due à la coccidiose. *Annales de médecine vétérinaire*, Vol 70, nº 3, pp. 101-107, bibliography. Brussels, 1925.

Coccidiosis is caused by *Eimeria avium*, an unicellular protozoa, living in the small intestine of the caecum of the hen. The presence of coccidiae is almost constant in adult fowls without causing casualties; the disease principally affects young chicks about 17 to 30 days old; the affected chicks have their feathers ruffled, suffer from a white, chalky diarrhoea, striped with blood; death ensues in from 3 to 7 days. Mortality may be excessively high and is heavier when the affected chicks are younger. An autopsy shows the principal injury to be in the caecum, the mucous membrane of which is eroded and contains the coccidiae. The latter ieproduce in two ways: (1) sexual reproduction, giving birth to the cocyst expelled by the germ bearers, capable of living in the external medium where it undergoes various transformations in 4 or 5 days and then becomes infections; (2) an asexual reproduction: when it reaches the small intestine, the oocyst sets free the sporozoites under the action of the digestive juices; these penetrate into the epithelial cells of the small intestine, curl up, grow at the expense of the cell, become spherical and are then called schizoites. At this stage the parasite undergoes various transformations and finally produces merozoites which penetrate into fresh cells of the small intestine.

At a given moment, these merozoites undergo a sexual differentiation and produce microgametes and macrogametes the union of which produces the oocyst and assures the perpetuation of the species.

Coccidiosis also occurs in older fowls and shows itself by symptoms which are generally not seen in the young chick. Mortality may be heavy; the fowls attacked suffer from paralysis especially in the feet, rarely in the wings. The disease runs its course in 7 to 15 days, reducing the fowls to skeletons.

As the different stages of the coccidia succeed one another inside the epithelial cells of the intestine, remedial agents have but little effect on the parasite and treatment should be primarily prophylactic.

The expelled oocyst requires 3 to 5 days before becoming [illegible] and must therefore be destroyed during this period by carefully removing and burning the excrements.

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A good layer of quicklime should be spread over the run and the earth turned over to a depth of 30 cm.; careful cleaning of the premises is an indispensable factor of success. As a medical remedy, cachou at a strength of 1 : 4000 has in several cases given satisfactory results.

Whipped milk may also be used, while greatly decreasing the grain or maize ration; a little grain is given in the morning, then whipped milk until 3 p. m., to avoid fermentation at night in the crop, and in the evening a rather larger quantity of grain so as to fill the crop for the night; when the milk is removed, water is placed at the disposal of the young chicks. This regimen makes the excrements rather liquid, consequently the floor of the poultry house should be covered with short straw, renewed every day; the premises should be well ventilated and kept quite dry and the temperature kept as even as possible. Avoid sudden changes of temperature and in the diet, which favour an outbreak of coccidiosis.

After 8 to 10 days of this diet the disease will be arrested and the paralysed chicks will rapidly recover. P. D.

863. **Variations and Constant Relations in the Quantity of Milk and the Fat Content.**

STREMLER, J. (Chemist to the « Compagnie générale du lait », Rumilly (Haute Savoie). Variations et rapports dans le quantité de lait et la teneur en matière grasse. *Le Lait*, Year V, Vol. 5, No. 44, pp. 353-359. Lyon, 1925.

The object of this investigation was to decide the following questions: Which milking is richest? Which gives most milk? Has the interval between milkings any influence?

Two milkings a day, morning and evening, are assumed. The statements and conclusions which follow are based on a series of several hundred analyses made during a period of nearly 3 years, on mixed milk from a colletion of 3500 to 4000 cows. By means of rapid collection made twice a day, the milk of the evening was kept separate from that of the morning. All precautions were taken in the collection of samples.

In summer, in the district in question, 6 to 7 hours elapse between the evening milking and that of the morning and 17 to 18 hours between that of the morning and that of the evening; in winter, this is reversed.

The two milkings, were found to be equally rich, if made at 12 hour intervals and this holds for any season. In winter when the time which elapses between the morning milking and that of the evening is less than that which elapses between the evening milking and that of the following morning, the evening milk is richer than that of the morning to the extent of 7 gm. difference per litre. In summer, the reverse is the case; the morning milk is the richer to the extent of 4.5 gm.

At mid-April or at the beginning of September when the interval between two milkings in exactly the same (12 h.), the richness of the milk is exactly the same.

In determining which milking gives most milk, the interval between the milkings has most influence. In winter the evening milking is less abundant; in summer the contrary.

If the milkings are at an interval of 12 hours, there is the same quantity of milk.

From these observations the author draws the following conclusions:

(1) If the quantity of milk produced increases, the fat content decreases; the greater the quantity of milk, the lower the quality.

(2) The greater the interval between two consecutive milkings, the more abundant is the second, but lower in fat content.

(3) The quantity and fat content of the morning and evening milks are the same, for a large number of cows in good health, if the interval between these milkings is 12 hours.

(4) If, in winter, the morning milking (in summer, that of the evening) is less rich and more abundant in quantity, it is because, having more repose between the two milkings, the udder stores up more milk.

P. D.

864. The Effect of Season on Milk and Fat Production of Jersey Cows.

ELMER WYLIE C. (Department of Dairying, University of Tennessee, Knoxville, Tennessee). *Journal of Dairy Science*, Vol. VIII, No 2, pp. 127-131, 2 fig. 2 tables, bibliography. Baltimore, 1925.

It is a well established fact that the milk production of a cow decreases as the lactation period advances and that the percentage of fat in the milk increases in the course of the same period. On the other hand recent researches have shown that there is an important relation between the season of the year and the quantity and richness of the milk produced.

In order to determine the combined effect of the lactation period and the season on the production and richness of milk, the author has examined the records of over 2900 cows included in the "Register of Merit Record of Jersey Cows" of the American Jersey Cattle Club.

Cows which commence their lactation periods in May and in July give on the average richest milk respectively in the 9th and 7th month of their lactation periods. Those which commence in June give a higher average percentage of richness of milk in fat from th 8th to the 10th month of their period of lactation than during the 12th month.

The average annual percentage of fat in the milk was highest for cows commencing their lactation periods in July, August, September and was higher by about 5.45 %.

The annual production of milk was highest for cows commencing their lactation in July, October, November, December, January, February and March; it was in all cases more than 8800 lbs. (3992 kg.).

The production of cows commencing their lactation in April, May, June, August and September was less; the average difference between the two groups was however slight.

The average annual production of fat was highest for cows calving in July, October, November, and December, in all cases exceeding 47[illegible] lb. (216 kg.) That of cows calving in April, May and August was low and always below 468 lb. (212 kg.).

The season of calving and the period of lactation affect the richness of the milk, in the sense that the richest milk is obtained a certain time before the end of the lactation period depending on the month in which the cow has calved. P. D.

865. **The Food Value of Algae.**

BROCQ-ROUSSEUX. Utilisation des Laminaria pauvres en sucre pour la nourriture des chevaux. *Recueil de Médecine vétérinaire*. Vol. CI, No. 6, pp. 146-161. Paris, 1925.

Results of investigations undertaken by the author on the food value of Laminaria poor in sugar for feeding horses.

In a first experiment continued for 5 months in a regiment of artillery at Rennes, two batteries, one light and the other heavy, were selected the horses of which, numbering about 120, were given 2 kg., of algæ containing 17 to 18 % of sugar, in place of 0.600 kg. of oats and 2 kg. of hay, or, taking into account the equivalent of hay-oats, a replacement of 1.600 kg. of oats by 2 kg. of algæ.

Two batteries of the same strength served as control; at the end of the experiment no difference was noticed in the condition of the horses fed on algæ and that of the control horses.

It appears therefore that the Laminaria have a definite food value and are not dangerous to animals. The author in continuation of studies has investigated in what proportions algæ poor in sugar can replace either hay or oats.

1. *Replacement of hay by algæ poor in sugars*. — Experiment made with Laminaria, the sugar content of which was, on the average, 8.12 %; it dealt with two pairs of horses with two waggons travelling 21 km every morning at walking pace. Work at the same time, animals weighed on return form work, food weighed, water consumed measured, the residues of rations weighed next morning. After having determined the ration required to keep the animals at an even weight, with the given work and having accustomed the animals to algæ (period of preparation of the animals 131 days) the writer began to feed the algæ in place of hay, to one horse of each pair, the other horse continuing to get the equivalent ration (period of consumption of algæ 70 days). The horses received the following rations:

I			II		
Oats	5	kg.	Oats	5	kg.
Hay	3.850	»	Alga	2.5	»
Straw	[illegible]	»	Straw	[illegible]	»

At the conclusion of the experiment no noticeable difference was recorded in the weight of the horses, one of the animals consuming algæ left every day from 100 to 300 grm. It may therefore be admitted that 2.5 kg. of algæ can replace 3.5 kg. of hay, which implies that the Laminaria can replace the hay of the ration for animals working at walking

pace, and the equivalence in the case of a daily ration of 3.850 kg. is 3 of algæ for 4 of hay.

B. *Replacement of oats by algæ poor in sugar.* — Experimental conditions as before. After the period of equilibrium, one horse of the pair was given algæ. The animals not eating algæ were fed the equivalent ration:— Oats 5 kg., hay 3.85, straw 2.5 kg.; the others had 1 kg. less oats which was replaced by 1 kg. of algæ. After 30 days all the horses had gained in weight, but those which had eaten algæ gained less than the others. It was decided to raise the ration of algæ to 1.250 kg., the other conditions remaining the same; after 30 days 3 horses out of the 4 lost weight, the average being against the animals given algæ.

The ration of algæ was raised to 1.500 kg. and after 30 days all the horses regained weight, the increase being in favour of the animals given algæ; this was verified during a fresh period of 30 days, hence it appears that 1.5 kg. of algæ can replace 1 kg. of oats.

The ration of algæ raised to 2 kg. and then to 2.5 kg. enabled the accuracy of the above-mentioned equivalence to be verified, for the animals eating the algæ gained more weight than the others as soon as the equivalence was exceeded.

To sum up:—

(*a*) 1 kg. of algæ is equivalent to 1.33 kg. of hay;
(*b*) 1.5 kg. of algæ are equivalent to 1 kg. of oats, and;
(*c*) 2 kg. of hay equal 1 kg. of oats.

Hence, 1.5 kg. algæ = 1 kg. oats = 2 kg. hay.

There is close agreement of the figures, which proves that the equivalence determined by the two separate experiments is very nearly accurate.

The author has shown by these experiments that algæ are harmless as a food, as was proved by the large quantities of algæ consumed. Moreover, one horse was able to consume 585.4 kg. of algæ in 301 days without the slightest inconvenience.

It is easy to understand the interest which these researches have for farmers near the coast and also for those of other areas, for dried algæ are very easily kept for years without deteriorations.

P. D.

866. **The Effect of Cane Molasses on the Digestibility of a Complete Ration fed to Dairy Cows.**

WILLIAMS, P. S. (Department of Dairy Husbandry, Pennsylvania State College). *Journal of Dairy Science*, vol. VIII, No. 2, pp. 94-104, 6 tables, bibliography. Baltimore, 1925.

The author's experiments were made for determining the effect of cane molasses on the digestibility of a complete ration fed to dairy cows.

The experiments were divided into 3 series, A, B and C, and each of

the series included 3 tests: series B. and C. were exact repetitions of the 3 tests in the series A.

SERIES A.

Test 1: — 4 Holstein pure-bred cows getting a ration of concentrates + hay and ensilage.

Test 2: — The same 4 cows with the same ration as in test 1 + a quantity of molasses equivalent to 15 % of concentrates.

Test 3: — The same 4 cows with the same ration as in test 1 + a quantity of molasses equivalent to 25 % of the concentrates.

Each of the tests lasted for 21 days, of which 10 days were a preparatory period and 11 days the actual test.

During the whole experiment the animals were given a complete balanced ration (maintenance ration + production ration) calculated according to Armsby's food standards, so that at the conclusion of the tests there was no appreciable difference in the weight of the animals. Food and drinking water were given at regular intervals, 3 times a day, immediately after milking; in addition, the animals could drink daily at 10 o'clock after the daily weighing.

The molasses was dissolved in double its weight of warm water and the mixture poured over the food placed in the manger. A study of the milk production during the tests shows a progressive decrease in output such as occurs in normal conditions as the period of lactation progresses. All precautions were taken to collect carefully all the faeces and urine, separately for each animal. The excrements were weighed once a day at 8 o'clock in the morning.

The period of effective record was 10 days, for the 1st day of the 11 was omitted with a view to assuring as normal conditions as possible.

Exactly aliquot samples of excrements were taken daily and kept so as to constitute an average sample: at the expiry of each period of record, the nitrogen was measured by KÖENIG's method and the other constituents according to the methods usually followed. For calculating the coefficient of digestibility and compiling the tables the author assumes that the molasses is completely digested and, consequently, he does not take into account the nutritive elements of the molasses in calculating the food ingested. This method allows of direct comparison of the nutritive food ingested and the eliminations in the excrements in view of the calculations of the percentage of digestibility.

The numerical data of the experiments show that the digestibility of crude cellulose, of the non-nitrogenous extracts and of the ether extract is not uniformly affected, one way or the other, by the presence of molasses in the ration.

Molasses have a tendency to diminish the digestibility of crude protein and dry matter; however this decrease is so slight that it is scarcely appreciable in practice. P. D.

[866]

867. Yeast as Supplementary Food for Dairy Cows.

ECKLES C. H. and WILLIAMS V. M. (Division of Dairy Husbandry, University of Minnesota, St-Paul Minnesota). *Journal of Dairy Science*, vol. VIII No 2, pp. 89-93. Baltimore, 1925.

Researches on the effect of the use of yeast as supplementary food for cows in milk and its influence on the content in vitamine B of the milk produced.

The authors used, as animals for the experiment, 8 cows divided into two groups fed as follows :

	Group 1	Group 2
1st. Period (40 days). . . .	Basal ration + yeast	Basal ration
2nd. » (40 »). . . .	Basal ration	Basal ration + yeast
3rd. » (40 »). . . .	Basal ration + yeast	Basal ration

The first ten days of each period are considered as a trial period and the comparison of results is made for the 30 following days.

The basal ration was composed as follows : — lucerne hay, maize silage, dry beet pulp and a concentrate (ground maize 2, ground oats 2, wheat bran 2 and linseed cake 1). The fodders were given *ad libitum*, the concentrate was fed in such proportion as to give slightly more than the protein and energy needs required, calculated according to Armsby's standards, so that the yeast supplement might act fully, without limitation consequent on a deficiency of food.

Dry commercial yeast was used at the rate of 55 gm. per day and per kg. of milk produced (25 gm. per day and per pound). The following are the results obtained : In group 1, the average yield of milk during the periods in which the supplement of yeast was fed was 26.4 lbs. per day against a daily average of 26.5 lbs. during the 2nd period without yeast.

For group 2 the average yield was 25.6 lbs. for the periods with basal ration against 25.2 lbs. for the period with basal ration + yeast. As regards the average daily yield in fat the respective figures were :

Group 1 : 0.942 lbs. without yeast and 0.957 lb. with yeast.

Group 2 : 0.897 lbs. with yeast and 0.925 lb. without yeast.

The addition to a normal ration for dairy cows of yeast to the extent of 25 gm. per day and per pound of milk produced does not cause either an increased yield nor an increase in the richness of the milk; further no special effect was noticed either in the state of health or in stimulation of appetite. P. D.

868. The Volume of the Ration.

LEROY, A. M. (Head of the Stock Breeding Department of the National Agricultural Institute) Le volume de la ration. *Revue de zootechnie. La revue des éleveurs*, Year 4, No. 5, pp. 299-305. Paris, 1925.

In the problems of the scientific feeding of animals it is [illegible] to determine the number of forage units contained in the daily ration [illegible]

calculate the quantity of energy necessary to an animal organism situated in given conditions of production, to investigate the value of the minimum daily supply in proteins, the presence of which in the foods enables the symptoms of lack of nitrogen to be avoided, but it must also be assured that the daily quantities of forage which the application of the usual method provides are in proper relation to the digestive capacity of the animals in question, especially so that excess may be avoided.

Species of domestic animals react differently under the influence of a ration too rich in indigestible matter : ruminants have a greater capacity than horses for the consumption of bulky foods ; pigs, proportionally to their weight, have the smallest digestive capacity.

Each animal should receive a given quantity of dry matter, neither too much nor too little, which depends on its species, weight, age and the nature and intensity of its production. It is therefore necessary to determine the coefficient of bulk of each of the forages capable of being included in the ration, that is to say, the quantity of dry matter, expressed in kg., contained in a forage unit of each of the foods considered.

In a table the author calculates the coefficients of bulk of some of the principal forages based on the fact that green forages represent, in proportion to the volume of the ration, the best balanced category of foods ; he deduces from this that the coefficient of bulk of rations should as nearly as possible approach the figure which corresponds to meadow grass, namely 1.3.

In a second table are shown the amplitude of variations in the coefficient of bulk of the ration admissible for each species and in each particular case. The practical application of the preceeding data are then studied by considering a type ration for a dairy cow of 700 kg. giving 30 litres of milk per day. The ration contains 15.03 forage units and 21.89 kg. of dry matter ; the coefficient of bulk is therefore :

$$\frac{\text{dry matter}}{\text{forage value}} = \frac{21.89}{15.53} = 1.46$$

It is evident that it is not possible, without causing a loss of appetite and consequently a decrease in production, to replace in the proposed ration a portion of the concentrates by hay or straw.

This method of calculating the bulk of the ration is simple and enables the content in dry matter of a ration to be usefully modified, without modifying its forage value, that is to say to determine the possibility or otherwise, from a physiological point of view, of food substitutions, which may appear desirable on account of the market rates of foodstuffs. P. D.

869. **Experiments on Stock Feeding at the Stock Breeding Centre of Clos Ry (Nièvre, France).**

MASSÉ, A. Expériences sur l'alimentation du bétail au Centre Zootechnique du Clos Ry (Nièvre, France). *Comptes Rendus des séances de l'Académie d'Agriculture de France*, Vol. II, No. 8, pp. 297-310. Paris, 1925.

An account of some experiments carried out at the stock breeding Centre of Clos Ry, relating to the scientific feeding of stock.

The first experiments dealt with the fattening of pigs; 12 pigs were taken, 6 of Craonnais breed 8 ½ months old, and 6 derived from a cross Large White-Craonnais, 7 months old; the 12 animals were divided into 3 lots of 2 pure Craonnais and 2 Large White-Craonnais, subjected first of all to the same diet, and afterwards to different feeding. The conclusions as to the net cost per kg. of increased growth, to the influence of the feeding on the quality of the meat, and to the influence of the breed on the aptitude for fattening, may be summed up as follows:

Potatoes and barley meal may be replaced by oil cakes without disadvantage. Palm oil cake is liked by the animals, even in large quantities, and its use is very profitable.

Substitution may be effected on the following basis: 1 kg. of cake = 1 kg. of barley; 1 kg. of cake = 4 kg. of potatoes.

A series of experimental researches were next carried out on sheep meat production with Southdown, Berrichon and industrial cross-bred Southdown × Berrichon. Two lots of 20 lambs were formed, each including 10 males and 10 females and, in each lot, six twin lambs. The mothers had received the same feed of hay and mangels; the lambs were also given the same feed and received from the 30th day a ration which was progressively increased, composed of mangels, bran and barley meal.

After a few months, 5 males of each lot were castrated.

From the records made it appears that: In each breed, the males are larger at birth than the females and in the Southdown breed the difference is greater; in both breeds subsequent growth seems to be in direct correlation with the initial weight.

Advantage from a growth standpoint lies decidedly with the castrated lambs.

From the point of view of comparative growth the Berrichon is slightly better than the Southdown; the average daily growth was in fact 0.1775 kg. for Southdowns and 0.1919 kg. for Berrichons. From the yield standpoint the advantage lies decidedly with the Southdowns, with a yield of 53.2 % against 49.3 % for the Berrichons. The author remarks that he is dealing with the results of only one year, that this should be taken into account in drawing conclusions and that the experiments should be continued and also carried out on crossbred Southdown Berrichon lambs.

A third experiment dealt with the comparative value of barley meal and manioc meal for fattening cattle. The experiment was made on young Charollais bullocks aged from 16 to 20 months, of the same paternal origin and as similar as possible as regards shape and fineness of tissues. Two lots as homogeneous as possible were put into stalls on the 17 November and given the same feed up to the 22nd, hay and mangels mixed with chopped straw. From the 22nd they received equal rations, except that for the 2nd lot the manioc meal fed to the bullocks of the 1st lot was replaced by an equal weight of barley meal. It was noted that the manioc meal mixed with the mangels was as much liked as the barley meal; the nutritive value is approximately the same.

Consequently, the use of one in preference to the other should be decided by the market prices of the two foods. T. D.

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870. **The Breed.**

DECHAMBRE P. La Race. *Revue de Zootechnie, La Revue des éleveurs*, Vol. IV, N° 4, pp. 251-259. Paris, 1925.

The Higher Committee of Herd Books, in consequence of a discussion which occurred during one of the meetings of the Congress of Herd Books charged one of its members to study and report on the question of the "breed" so that satisfactory understanding might be arrived at regarding the signification and scope of this term in frequent general use.

The author studied the term and its significance as used in biology and in general ethnology, and in breeding practice, to draw from them useful conclusions for stock breeders.

The distinction which should be established between *breed* and *type* must be clearly understood.

The *Type* should be considered as the form round which individuals composing the breed are grouped ; it appears as a theoretical figure independent of all idea of affiliation and living representation.

The *Breed* is constituted by the collection of individuals which descend one from another and which possess the totality or the greater part of the characters of the type.

Hence, a type being given and defined by a small number of characters recognised as fundamental, may be represented by several breeds separated from each other by one or several distinctive characters.

Regarding the breed in the practice of breeding, it may be defined as a collection of individuals of the same species, in which identity of origin is expressed by similitude of bodily forms, coat, plumage, having the same productive qualities, the same temperament and the same aptitudes.

It is however very difficult to prevent the signification of the term "breed" from having a certain conventional character, which in the consequence of several circumstances inherent to habitual conditions of the practice of breeding :

(1) Breeds, even the best defined, always contain individuals which resemble more or less, neighbouring breeds.

(2) In many domestic species and for many economic or other reasons, cross-breeding has happened frequently enough for there to be difficulty in determination and delimitation, even in breeds qualified as pure.

(3) The term "breed" is often applied, in practice, to groupings of artificial origin obtained by the mixture of several others. Cross-breeding has given rise to a great number of these combinations as well as continuous crossing not extended to total absorption. It is however right and necessary to note that if in certain cases the qualification of breed is unsuitable to too recent operations of crossing or cross-breeding, in others it is justified by the homogeneousness of the characters, the almost complete absence of throwing back and the care with which multiplication is looked after.

Hence, it may be said that:

(*a*) The *breed* is the genetic group which comes immediately after the species in the scientific nomenclature ordinarily adopted.

(*b*) It is defined by a collection of general characters which are *ethnical* characters (profile, form of the head, proportions, weight, coat, horns, hair, etc.) and not *specific*.

(*c*) A given breed belongs to a given type, that is to say to a general diagrammatic formula of which it is the representation drawn from a [illegible]able number of individuals.

(*d*) The same breed may be differentiated into secundary groups or "sub-breeds" which however should not be multiplied, but, on the contrary, should be made to return to the same general formula as soon as the essential morphological characters and the aptitudes are the same.

(*e*) The term "*variety*" actually corresponds only to a group in process of formation whose characteristics are not yet fixed.

(*f*) In the case of groupings obtained by crossings or by cross-breedings, the appellation "breed" should only be conceded after much circumspection, so as not to accord it to groups in process of formation without stability and without guarantee of true breeding quality.

(*g*) All the above considerations are necessarily of a very general character, for they should apply to all domestic species with which the Higher Committee of the Herd Books may have to deal. P. D.

871. Are Milk Record Association Results Accurate?

CANDLISH, A. C. and VICAR, A. (Milk production Department, West of Scotland Agricultural College). *The Scottish Journal of Agriculture*, Vol. VIII, No. 2, pp. 201-205, 4 tables. Edinburgh, 1925.

In view of the investigation of the degree of accuracy of results obtained by milk record associations these results have been compared with those given by the weighing, after each milking, of the milk yielded by each cow of a single herd.

The estimate of yield according to the results supplied by the milk record made at intervals of 10, 20 and 30 days, so as to determine the influence of the period between two records on the accuracy of the results, was effected by two methods.

(*a*) Old method: at the time of the first record of the lactation the total milk (morning milking + evening milking) given by each cow was multiplied by the number of days which have elapsed since calving; at the time of subsequent records the total quantity of milk of the two milkings was multiplied by the exact number of days elapsed since the previous record.

(*b*) New method: At the time of the first record of the lactation the total quantity of milk of the 2 milkings of a cow was multiplied by the number of days elapsed since calving + half the [illegible] average interval between records; at the time of subsequent records, the total quantity of milk of the 2 milkings was multiplied by the exact num-

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ber of days between the records, that is to day, the day of record was considered as the middle day of the period included in the record.

The following is the average of results obtained with 24 cows:

Number of cows	Actual yield (weighings)	Estimated yields					
		Old method			New method		
		Tested every 10 days	Tested every 20 days	Tested every 30 days	Tested every 10 days	Tested every 20 days	Tested every 30 days
24	642 gallons	631 gallons	617 gallons	594 gallons	647 gallons	647 gallons	643 gallons

The average results obtained by means of the old method of estimation with the figures given by records made at 10 days interval, differ from the true average obtained by weighings of the milk by less than 2 %; with the new method, the results are a little closer and differ from the true average by less than 1 %.

If instead of considering average results the individual records are observed we get the following table:

Method	Average yield	Variation from the actual average yield	Maximum variation		Extent of variation
			Increase	Decrease	
	Gallons	Gallons	Gallons	Gallons	Gallons
Old method:					
Tested every 10 days	631	— 11	9	36	45
» » 20 »	617	— 25	—	65	65
» » 30 »	594	— 48	—	93	93
New method:					
Tested every 10 days	647	5	24	13	37
» » 20 »	647	5	25	32	57
» » 30 »	643	1	46	36	82

The records estimated according to the new method with intervals of 10, 20 and 30 days between records do not show any important variations compared with the actual yield, when the average for the herd in considered the individual variations increase according as the interval between successive records is increased. However, even with a period of 30 days between 2 records, they are not large enough to destroy the practical value of the results.

This is not the case for results obtained according to the old method of estimating the yield; with that method, with 10 days interval, the average variation is less than 2 %, but increased to 4 % for 20 days interval and to over 7 % for 30 days interval.

The new method of estimation therefore gives a much closer approximation in all cases than the old method.

The study of the length of the period of lactation throws some light on this subject.

The average actual length of the period of lactation is 265 days according to the new method of estimation we get 265 or 264 days as the average length of the period of lactation, while with the old method the average length of the period of lactation is respectively 261,256 and 251 days for the respective intervals between 2 records of 10, 20 and 30 days. This means that, according to the old method of estimation, the average length of the period of lactation is shorter than the actual length by about one half of the period between 2 testings. This is due to the fact that the end of the period of lactation does not always coincide with a testing day, but more often occurs at some time or other between 2 consecutive testings. The weighing operations and the calculations of the yield did not commence on the average, until the 5th day after calving, that is to say at the end of the period of the colostrum; for greater accuracy the average production of the first 5 days, about 18 gallons, should be added to the average production indicated.

Hence, it may be said that the new method of estimation gives very satisfactory results, sufficiently accurate for the estimation of records.

P. D.

872. **Calculating the Average Production of a Dairy Herd.**

BECKER, R. B. (Division of Dairy Husbandry, University of Minnesota, University Farm, St-Paul, Minnesota). *Journal of Dairy Science*, vol. VIII, No. 2, pp. 105-114. Baltomore, 1925.

To appreciate correctly the value of a dairy herd, it does not suffice to consider the exceptional records given by certain cows, but on the contrary a high average production of the whole herd should be sought for as proof of power to transmit the character of high productivity.

The object of the author's report is to discuss some of the methods of estimating the average production of herds hitherto used and to being to notice a more accurate method recently devised by himself.

For the comparison of methods the author utilizes the production records of a herd belonging to the Sunflower Cow Testing Association of North West Kansas.

The "equivalent average" method considers the number of milking days in the course of the year; by dividing this number by 365 we get the average number of cows milked each day. If the total production in milk and in fat is then divided by the average number of cows milked each day, the average production per head per annum is obtained. This method based on the supposition that the cow is milked 365 days a year, gives too high results not giving an accurate account of the average production, especially in a herd in which the cows have an abundant milk production in a short period of lactation.

The "rough average" method estimates the average production by dividing the total production of the herd by the total number of cows which have calved before or during the course of the year considered. This method somewhat under-estimates the actual average production of the herd, it does not allow for cows which do not accomplish a complete period [illegible]

of lactation (sale, death); in addition the heifers which commence their lactation towards the end of the year cannot give the complete and accurate measures of their capacity of production, but enter into the account in the calculation of the average production.

The "herd average" method only takes into account for calculating average production, the cows which have commenced their period of lactation before the beginning of the year of record and which accomplish a complete lactation on the strength of the herd in the course of the year in question. This method, more accurate than the two previous methods, has however the defect of not taking into account cows which only accomplish part of their period of lactation during the course of the year considered.

The "cow-month" method brings into account for calculating the average production of all cows in the herd, in lactation or dry, for each month of the year. This total number of "cow-months" for the year divided by 12, gives the number of "cows" in the herd for the whole year.

By dividing the total production in milk and fats by this latter number the average production is obtained with a fairly great degree of accuracy. However, the figure for the average production is slightly too high, for the dry period for heifers commencing their period of lactation towards the end of the year of record is not taken into account.

The Danish method of calculating the average production of a herd is based on the number of days during which the cows consume food during the year. The total of feeding days is divided by 365 so as to get the number of cows in the herd during the whole year and from that the average production is calculated.

This method gives results very near the truth, but however tends to over-estimate slightly the figures of the average production, for it does not take into account a dry period for heifers commencing their period of lactation late.

The author proposes the "lactation average" method. It is based on the average length of the period of a normal cow in the herd; cows which accomplish their normal lactation in the course of the year are counted as such (1); for the cows which only pass a part of their period of lactation in the herd during the course of the year considered, the equivalent number of cows which would have accomplished a complete average lactation is calculated, (2) according to the normal length of the lactation of normal cows of the herd.

The total of (1) + (2) gives the real number of cows in the herd during the whole year and enables the average yield of the herd to be calculated.

The last four methods give results which are near the truth; however the last method, taking into account a proportional dry period for the cows which only accomplish a part of their lactation during the course of the year considered, represents the normal situation of the herd better, and gives a more accurate result of the true average production.

F. D.

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. *Special.*

873. Feeding Experiments with Dairy Cows.

FREDERICKSEN, Prof. L., ANDERSEN, A. C. (Manager) and WENZEL, H. (Assistant). I. Foreløbige oplysuingen om nogle Forsøg met Malkekøer i vinteren 1923-24. II. Plan for nogle Forsøg med Malkekøer i vinteren 1924-25. II. *Meddelelse fra Forsøgslaboratoriet Husdyrbrugsafdeling*, pp. [illegible], [illegible] tables, 1 graph. A Bang, Copenhagen, 1925.

Second Report of the Domestic Stock-breeding Department of the Experimental Laboratoy.

Preliminary information regarding experiments with dairy cows made during the winter of 1923-24.

A. Constant quantity of Feed and varying Quantity of Protein.

The experiments were carried out by Professor Lars FREDERICKSEN on five farms with 120 cows and in accordance with the following scheme for the amount and type of fodder (three batches of cows).

Batch A:	1 F. U.	with	120 gm.	protein per	2.6 kilos	4 % milk	(46.2 gm. protein per kilo 4 % milk)
» B:	1	»	96 »	» »	2.6	» »	(36.9 » » » » » »)
» C:	1	»	144 »	» »	2.6	» »	(55.4 » » » » » »)

The reason why 4 % milk has been chosen for future calculations is explained in the report. In accordance with a very great number of tests of the average combinations of Danish cow's milk it is possible — the fat percentage of milk being known — to find the approximate content of other substances in the milk and to calculate on this basis the heat of combustion of the milk. Mr. A. C. ANDERSEN states this to be (fat percentage × [illegible]) + 290 calories per kilo. Professor K. MOLLGAARD has further found that the cost of producing 1000 calories in milk is almost the same whether its fat content is high or comparatively low. In bulletin No 245 of the University of Illinois, W. L. GAINES and F. A. DAVIDSON, following large scale tests of the yields of American cows, suggest the use of the so-called 4 % milk in comparing the yields of dairy cows. The quantity of 4 % milk is found by multiplying the absolute quantity of milk by 0.4 adding to this the fat content of the milk × 15. Professor FREDERICKSEN shows in a table that one kilo of 4 % milk practically contains as many gms. of protein and as many calories, whether the calculation is made with a fat percentage of 3 or 7.

As regards the carrying out of the experiments, it should be noted that it is necessary to distinguish between a preparatory stage, an experimental stage and a later stage. In the preparatory stage the object was to form three uniform batches, A, B, and C, which in the following experimental stage (about three months) are fed differently: A, normally; B, below the normal; C, above the normal. In the preparatory stage and the later stage, all batches were fed alike (as A in the experimental stage) in proportion to the yielding and body weight of the individual cows. On [illegible] farms respectively, 4.0 and 3.5 kilos of lucerne hay were fed daily [illegible]

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the experimental stage to each cow. For batch B the quantity of oil cake on these farms is less than 1 kilo per cow daily. Batch A on these farms was fed daily about 1 $^{2}/_{3}$ kilos of oil cake per cow and batch C about 2 $^{1}/_{2}$ kilos of oil cake. For the three farms where hay was not used for fodder, the quantity of oil cake varies per cow and per day from 1.4 kilos (B) to 2.9 kilos (C). The mixture of oil cake was the same for all the farms, having been bought in one lot (the so-called "Korsor mixture" see below). In the feed were also included maslin, mangolds and straw. The maintenance ration is computed in proportion to the body weight of the cow; 50 gm. protein is reckoned to be contained in it per kilo body weight and is for:

400 kilos live weight	2.5 F. U.	containing	200 gm. protein
500 » » »	3.0 »	»	250 » »
600 » » »	4.5 »	»	300 » »

On an average the following results have been obtained during the experimental period:

		Average for A	B	C
In the feed, gm. protein per kilo 4 % milk		50.2	40.4	58.6
Yielding per cow daily	kilos milk	13.9	13.4	14.1
	gm. butter fat	507	503	518
	kilos 4 % milk	13.2	12.9	13.4
Average weight of cows, kilos		503	502	498
Increase per cow in 100 days, kilos		8.4	3.1	11.6
For 100 production F. U.	kilos milk	250	250	255
	kilos butter fat	9.11	9.40	9.35
	kilos 4 % milk	237	241	242
	kilos growth	1.51	0.58	2.09
For 100 F. U. altogeter	kilos milk	146	144	148
	kilos butter fat	5.30	5.37	5.44
	kilos 4 % milk	137	137	140
	kilos growth	0.88	0.33	1.22

The preliminary statement respecting the two years' experiments with constant quantity of feed (1 F-U per 2.5 kilos 4 % milk) and varying quantity of protein, signifies that the greatest aggregate yield for 100 F-U altogether, is obtained by such batches as have received 50 gm protein and over per kilo of 4 % milk. With 40 gm. protein per kilo of 4 % milk (batch B 1923-24) during the experimental stage, a decided decrease in the quantity of milk was shewn. An increase in the quantity of protein from about 50 to 60 gm per kilo of 4 % milk (A to C 1923-1924 and B to A 1922-1923) seems to have caused a small increase in the yields. A further increase in the quantity of protein from about 64 to 73 gm per kilo of 4 % milk (A to C 1922-23) seems to have caused a small increase in the quantity of milk, but at the same time the growth had decreased.

Taken on the whole the outcome of the experiments with constant quantity of feed and varying quantity of protein, have not been very significant, nor have they been quite homogeneous for all the farms.

B. The special influence of certain kinds of fodder on the quantity and fat content of the milk. Experiments with coconut and palm-nut cakes. By HANS WENZEL.

During the winter 1922-23 a new kind of cake, called "Babassu cake" was tried in a single experiment, with the result that one batch of cows fed with babassu cake thrived just as well as another batch that received coconut cake, and it also appears that for cows that had both kinds of cake, the fat percentage of the milk increased in comparison with other cows fed with other kinds of cake. For a closer investigation of these results an experiment was made during the winter 1923-24 with coconut and palm nut cake compared with others. All the four batches of cows were fed according to the same scheme as the normal batches (A) in the above mentioned experiments, *i. e.* the quantity of feed increased and decreased with both, body weight and quantity of milk and percentage of fat. All cows therefore, have all the time received the same number of F. U. and gm. of protein. The only difference for the batches was the kind of cake at the experimental stage. The cake mixture of the normal batch (the "Korsor mixture") with which the other mixtures are compared, was composed of:

30 % of coconut cake,
30 % sunflower cake,
10 % earthnut cake,
10 % soy cake,
10 % sesame cake,
10 % palmnut cake.

In the experimental stage the various batches received:

Batch A: "Korsør Mixture",
» B: $^1/_2$ » » and $^1/_2$ of coconut cake (65 % coconut cake and 5 % palm cake),
» C: $^1/_2$ » » and $^1/_2$ of palm cake (55 % of palm cake and [illegible] coconut cake),
» D: $^1/_4$ of sunflower cake, $^1/_4$ soy cake, $^1/_4$ earthnut cake and $^1/_4$ [illegible].

All the cows each day had on an average [illegible] kilos of [illegible] and 5 kilos straw. Of oil cake, A. had about 2 ⅓ kilos, B. 2 ⅓ kilos, C. almost 4 kilos and D 1 $^2/_3$ kilos per cow daily. The difference in the quantity of cake is due to the fact that the quantity of protein per F.U. had to be the same for the batches, and this was obtained by adding [illegible]. All batches during the preparatory and subsequent stages had "Korsør mix-

ture " instead of cake. The daily average yield per cow (in milk and fat) throughout the experiment was:

		A 30 % coconut cake and 10 % palmnut cake	B 65 % coconut cake and 5 % palmnut cake	C 15 % coconut cake and 55 % palmnut cake	D No coconut or palmnut cake
Kilos of milk	preparatory stage	17.6	17.5	17.6	17.5
	experimental »	14.8	16.0	16.1	15.2
	subsequent »	11.8	12.9	12.7	11.4
% fat	preparatory stage	3.84	3.68	3.67	3.67
	experimental »	3.76	3.74	3.69	3.43
	subsequent »	3.79	3.62	3.63	3.63
gm. fat	preparatory stage	676	644	646	642
	experimental »	556	596	595	521
	subsequent »	447	497	461	414
Kilos 4 % milk	preparatory stage	17.2	16.7	16.7	16.6
	experimental »	14.2	15.3	15.4	13.9
	subsequent »	11.4	12.2	12.0	10.8
Actual experimental stage	growth per cow in 100 days, kilos	13.1	11.9	9.5	8.3
	average weight of the cows, kilos	511	475	485	495

The chief results of the experiments may be thus indicated.

The experiments of 1922-23 and 1923-24 show that certain feeding stuffs have a considerable influence on the fat percentage of the milk. The more coconut, babassu or palm cake contained in the cake mixture, the higher became the percentage of fat. By exchanging half an artificial feed mixture with coconut or babassu cake the fat percentage was raised ⅓ %, and by omitting the 30 % coconut cake and 10 % palm cake contained in the Korsor mixture and replacing them with the other kinds of cake of the Korsor mixture, the fat percentage was lowered ¼ %.

The influence these cakes have on the quantity of milk is not clearly shown by the experiments, the results of the two years not indicating the same tendency, but even where a decrease has occurred in the quantity of milk, the batches fed with babassu, coconut, or palm cake have, however, in every case yielded the largest quantity of butter fat.

C. The ash content of the Milk (minerals especially lime and phosphoric acid. A. C. Andersen.

The purpose of the experiment was to ascertain whether the content of lime and phosphoric acid in the milk is subject to important fluctuations during the winter, or is chiefly influenced through the addition of minerals or bone dust. To illustrate this point, large samples were sent in during the period 4th January to 20 June, from the experiments at Rosenfeldt, of the milk of 4 batches for each period of a fortnight. The normal experiments on the farm (under section A) dealt with these batches which, besides the recognised experimental fodder, had a daily addition

of about 50 gm. chalk and bone-dust (equal mixture) per cow; a fourth batch, fed in the same manner as batch A under section A, on the other hand had no addition of chalk and bone-dust.

Altogether, milk samples for 12 periods were sent in, of which the two last periods include the time after the cows had been turned out to grass. From the analytical results it appears that the variations found in the content of phosphoric acid, lime and magnesia, are only [illegible] and the batch without the addition of chalk and bone-dust was in no way different from the other batches.

No regular variation in the combination appears during the stall feeding period. On the other hands it seems as if the content of phosphoric acid in the milk decreases, while the content of lime increases when the cows are turned out to grass, but further investigations are necessary before anything definitive may be said on this subject.

Corr. Denmark.

874. **Milk-Production and Draught-Efficiency.**

GUTH. Milchleistung und Zugleistung Burgenländische Rindviehzucht-genossenschaften. *Wiener landwirtschaftliche Zeitung*, No. 15. April [illegible]. Vienna.

In the recently formed association for cattle-breeding in Unter[illegible], in Burgenland, the newest Austrian confederate country, there was intro-duced more than a year ago an efficiency test. Of the 110 cows tested, 87 were not only employed for milk-production, but also for draught. The average annual production of the cows not used for draught purposes was 2490 quarts (2827 litres), that of the "draught-cows" however [illegible] quarts (2252 litres). Thus on an average per year and per cow, 506 quarts (575 litres) of milk were lost As the feeding of all the cows was the same, the equivalent of a cow's draught-efficiency may be calculated as equal to the value of 506 quarts of milk. Hence, it is a question of estimating in each case, which is most economical, milk-production or draught-efficiency, and to ascertain when the loss of milk begins to exceed the cost of a draught animal. Of the dairy cows 75 % gave more than [illegible] quarts (2500 litres) a year, whereas of the draught cows only 26 % gave as much. The maximum milk-yield per cow was 4181 quarts ([illegible] litres), which, taking into account the primitive breeding and methods of keeping, must be considered as a satisfactory result.

H. K.

875. **Improvements in Sheep Breeding in Morocco.**

LALLOUR, M. Améliorations de l'élevage du mouton au Maroc. [illegible] *Zootechnie*, la revue des éléveurs, Year 4, No. 4, pp. 279-285; No. 5, pp. 342-352. Paris, 1925.

The number of sheep in the French zone of the [illegible] may be estimated at 10,000,000 head, of which [illegible] in 1924. The evolution of such a flock has, for many [illegible] principally by persevering selection of indigenous [illegible]

[illegible]

very difficult to procure imported rams in sufficient numbers; their acclimatization is difficult and mortality high, owing to present conditions of life and also the Moroccan sheep will not be suitable for useful crossing with foreign strains before several years of selection.

The most necessary measure to be taken for the improvement of the Moroccan flocks is a methodical and energetic scheme of selection; the Administration of the Protectorate has begun by the development of castration. The progressive, but as rapid as possible realization of all other processes of selection must now be considered, but the susceptibilities of the natives must be treated with consideration.

The first effort should bear on the native Provident Society and on the important flocks belonging to influential Kaïds; it must next be endeavoured, by emulation and interest, to incline other native breeders to adopt the same methods of selection until it becomes possible to impose them without difficulty, by regulations, on defaulters.

Selection of rams: (*a*) *Castration*. — During the last 2 years the "Service de l'Élevage" has made a great effort to develop the practice of castration by the use of the Italian pincers. Apart from the production of meat intended for quick consumption, castration on a large scale has for its principal object the selection of rams by the elimination of bad breeding animals. Of course, only the veterinary should be authorized to select the rams to be kept and this selection should not be left to the native castrators who work empirically and contrary to the most elementary stock breeding principles.

(*b*) *Isolation of the rams*. — In Morocco, in the large majority of cases, the ewes and the rams are mixed throughout the year; consequently there are lambs of unequal age and endurance, and lambing at certain seasons entails a heavy mortality. Absolute isolation of the rams during 10 months of the year is not practicable among natives, for that is contrary to long tradition, entails extra cost of herding and deprives the breeder of the double lambing to which he is accustomed. Isolation during 3 months, from the 1st February to the 1st May might be considered: this would prevent lambing in the summer which is detrimental to the ewes and lambs, while facilitating the marking of animals to be kept for selection and those to be castrated or killed. The native owners of large flocks having experience of the mortality in summer and autumn would readily agree to this reform; for the small and medium sized flocks, it would be necessary to institute herding for 3 months at common cost, taking the "*douar*" as unit.

(*c*) *Bonuses for the keeping of classed rams*. These were awarded to the owner of the best selected rams and paid one year after award if the animal was shown in a good condition of preservation and maintenance. They are at present abolished. After experience of the new system of bonuses the "Union Ovine de l'Afrique du Nord" may investigate with the "Service de l'Élevage" whether the re-establishment of this system would be of real use.

Selection of ewes. — This appears to be very difficult to realize in Morocco. In the native flocks, the ewes bear when too young and defec-

mations result which are very prejudicial to subsequent gestations; they also bear too old, when they can no longer give any but inferior products. The isolation of ewe lambs and the feeding of old, sick, rickety ewes can only be effected through a slow process of propaganda and example by European breeders. Veterinary inspectors should be allowed to purchase for the native Prudential Societies, exceptional animals which they discover in the slaughter-houses. The most urgent questions were the regulation of slaughtering and the export of young ewes; the "dahir" of 12th the June 1920 forbade throughout the French zone of the Shereefian Empire the slaughter of ewes under 2 years old and the "dahir" of 27th January 1923 prohibited the exportation of ewes under 5 years old, except through the customs stations of the Algerian-Moroccan frontier, from the 1st January to the 30th June.

Rigorous application of these measures meets with practically insuperable obstacles. A centre of supervision for the "filtering" of flocks in course of exportation has just been organized at Taza (Vizirial Decree of 7th January 1925, B. O. of 13th January 1915).

The "Union Ovine de l'Afrique du Nord" might usefully help the Moroccan Administration by investigating with the General Government of Algeria the possibility of effecting the unification of the regulations in force in the two countries in the matter of the slaughter and export of ewes.

Selected flocks. — Owing to the difficulty of procuring for native flocks a sufficient number of good rams for their improvement, it is necessary to bring about the constitution of a flock of selected sheep by each of the native Provident Societies for which the best rams would be reserved. This measure would usefully supplement the institution of experimental sheepfolds started by the "Service de l'Élevage"; applied at once and generalized afterwards it would exercise a very favourable influence on the rapid improvement of sheep-breeding in Morocco.

Each selected flock, subjected to the direct control of the veterinary, benefitting by scientific methods (breeding, reproduction, feeding, shelter, care, etc.), would form a nursery of selected breeding animals and a useful example to native breeders.

To constitute them, rams would be purchased by the native Provident Societies and could be obtained either by selection or by importation. The ewes would be borrowed free of charge from native flocks and restored at the age of 5 years to their owners. The lambs, in principle, would belong to the owner of the mother. Until the natives learn the advantages of the system and agree to share the expenses, the cost should be borne by the native Providant Societies.

Cross-breeding. — The introduction of an improving strain is indispensable to the Moroccan flocks for the production of the good quality of wool and meat, of which they are capable; experiments have shown that these flocks are capable of benefitting from the first generation, from the important characters of the imported rams. The experiments of the "Service de l'Élevage" are convincing for mass breeding from Cran d'Arles merino rams, either pure-bred or cross-bred with Tunisians.

It would be very desirable for the "Union Ovine de l'Afrique du Nord" to take the initiative in establishing stud farms in the principal breeding centres, where selected rams would be kept and given the necessary care during the intervals in the breeding periods. They would be hired to breeders at the breeding period when they would be supervised by a specially responsible interested keeper.

Organizations of this kind would be realizable under the form of breeders' co-operative societies, deriving their inspiration from the organization of the Moroccan Remount Service.

The "Union Ovine de l'Afrique du Nord" could facilitate the importation of good breeding animals by organizing, in Morocco, annual ram sales following the procedure of the "ventes à porte". A Decree of the 2nd March 1924 of the Director General of Agriculture has fixed at one hundred francs per animal the amount of the premium instituted by the Vizirial Decree of 1st March 1924, to compensate importers of rams for part of the cost of customs and transport.

Feeding the flock. — The Moroccan sheep is noted for its hardiness, which is very fortunate, for rarely, owing to the laziness and neglect of the native, can it eat when hungry or drink when thirsty. It is to be hoped that the multiplication of dairy cows will cause the milking of ewes to be discontinued and that the example of European breeders and firm action of the authorities will lead to development in the constitution of forage reserves by means of ensilage and haymaking. Moreover, annual change of pasturage is practised in Morocco, very extensively in Eastern Morocco and to a limited extent in the Middle Atlas and Western Morocco. A better utilisation of the available grazing lands must be effected by arrangements between the Administrations of neighbouring regions.

The principal difficulty in keeping sheep in Morocco lies in the supply of drinking water. Much has already been done in this respect by the multiplication of wells, the construction of rough tanks open at the top; but the present state of affairs still leaves much to be desired. A great effort on the part of the Agricultural Irrigation Service is required to give value to large districts of "Sheep country".

Protection and hygiene of flocks. — The most obvious enemies of Moroccan sheep are the wild beasts; it would be desirable to increase hunting and to give rewards for destruction of wild animals. More destructive than the wild beasts are the numerous internal and external parasites which attacks the flocks. Regular development of veterinary inspections would be the best means of popularizing knowledge of elementary prophylaxis. The general adoption of dipping, with the obligation of active superintendance for maintaining a proper strength of the liquid would be very desirable. For the protection of the flock against weather conditions the native should be induced to make increasing use of rough shelters and to keep them in repair.

Shearing. — Takes place in Morocco from March to the end of May, from day to day, when there is leisure or the owner needs money. It is done with rough instruments and the shearers neglect to shear the wool on the belly. The cost of shearing by hand is very high: — 1 fleece in 15

or 4 to 5 % of the value of wood shorn, or the wool from the flock and head. Mechanical shearing, in addition to clearness and rapidity in the operation, would lead to supression of fraud and shearing wounds, simplification in prophylactic attention and facility of control of the sanitary condition of the animals, grouping of the operations of collecting and despatching the wool and a gain of 250 gm. of wool per fleece. The "Union Ovine de l'Afrique du Nord" should establish in the principal breeding centres shearing co-operative societies carrying out shearing on contract for the breeders and merchants. These co-operative societies could benefit by long term agricultural loans free of interest, by means of agreement between the Protectorate and the Morocco State Bank.

Frauds and classification of wools. — The adhesion of milk, sand, dung, etc. is the greatest obstacle to the development of trade in Moroccan wools. The breeders are not alone responsable and the middlemen share the responsability in a large measure. The "Union Ovine de l'Afrique du Nord" should do all in its power to carry out improvements in this respect.

A fresh classification of Moroccan wools is also imperative, for the present classification at Aboudia, Urdighia and Ba'dia appears to be too summary and uncertain. It is necessary to establish sufficient difference in value between the different qualities to induce the breeder to strive to produce the finest wools. The work of improvement of the stock of sheep in Morocco ought to,rest on the native Providant Societies, the Agricultural Co-operative societies of centres of breeding and mechanical shearing and the "Union Ovine de l'Afrique du Nord". It would be facilitated by fresh extension of breeding, which allotments of the colonization lots of [illegible] ha. arranged by the General Directorate of Agriculture would make possible.

It would be useful to create a post of Veterinary Inspector, whose duty it would be to suggest useful measures and to superintend their execution, and it is important that there should be on the staff of the General Directorate of Agriculture and of the "Service de l'Élevage", a sheep specialist to assure linking up and continuity of action. In any case, Morocco offers very great possibilities for the rapid development of the stock of sheep not only numerically but also in weight and quality. P. D.

Poultry.

875. **Poultry Breeding.**

WIENINGER (Adviser on Poultry Breeding to the Ministery of Agriculture and Forestry). *Geflügelzucht.* 2nd Edition, pp. [illegible], figs. [illegible]. Publishers SCHOOTEVERLAG, Vienna 1925.

In this publication WIENINGER, formerly a very successful farmer and cattle-breeder, deals briefly with what a poultry breeder must know in order to manage his breeding successfully and profitably. The book contains practical directions for the construction of poultry houses and utensils by the use of simple expedients, suggestions with respect to diseases, organisation of marketing and the economical importance of poultry [illegible]

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breeding. Artificial incubation and breeding, control of trap-nests and the keeping of accounts are briefly treated, also the more important breeds of poultry found in Austria.

H. K.

877. **Selection of Poultry at the Farm.**

LEGENDRE, G. La sélection des volailles à la ferme. *Revue de Zootechnie, La revue des éleveurs*, Year 4, N° 4, pp. 288-293. Paris, 1925.

The author discusses the question of selection of poultry at the farm and remarks that the best birds both as parents and as layers should be hatched earlier than they ordinarily are in the country: for cocks the earlier the better; for heavy hens, hatching in March should be sought, for light hens about the 15th April.

This principle being settled, the fowls can then be selected, the best chosen and the flock improved by eliminating inferior fowls. These two methods combined will give the high yield desired. A preliminary examination will enable all the birds with evident signs of unsuitability to be eliminated; this done only strong, healthy, anatomically well formed birds with compact plumage are kept for more searching examination. It is also desirable to have birds of the same type, giving homogeneous products of good quality, easier to sell and more profitable.

So far, selection has been based on elimination of the unsuitable. It is next necessary to consider what production is more specially aimed at; eggs or poultry for the table, for selection may differ according to one or other of these special objects. Selection will be based on appreciation, a method relatively lacking precision, but by far the most economical and capable of bring most serviceable to the farm.

Appreciation as regards egg production will take place at the commencement or decline of laying, never during its greatest activity; the early laying hen and the late laying hen should generally be kept, for often when the laying period is long the egg production is abundant.

A lively and sprightly external appearance of the bird, the colouration of the comb and gills indicate laying hens or hens about to lay, and spirited cocks. Among fowls which show these symptoms late, those which have the pelvis bones wide apart and supple should be kept; when laying commences these characters have less importance. Generally a good laying hen has a fine skeleton, the feet wide apart and neat, the body long, unless this is contrary to the type.

The secondary sexual characters (spurs, comb) should be well developed, and the colour of the skin and feet noted; handling will enable the birds to be judged for table purposes; the breastbone especially should be well covered.

Cocks should be kept whose sisters are good layers and whose brothers have been early in growth and have put on flesh.

The appreciations on which selection is based if taken singly are subject to doubt, but taken together give sufficient probability

The author suggests the following table of marking of points:

		Appreciation	[illegible]	[illegible]
The bird . .	Vigor . 20	Nervous organization . . . . Width and depth of brest 10	Regular rhythum of layi[illegible] % of fertility	50
	Type . 20	Standard		
Its products .	Eggs . . 10	Conformation . . . . Texture 20	Ancestors . . . . . . Individual . .	
	Flesh . 10	Handling . . . . Colour	Earlines of devel[illegible] Weight	
			Total . . .	100

The systematic application of these methods, supplemented when possible by exact data, will enable poultry to be judged, not by vague appearances, but by indications of their real value and will be the means of rapidly raising the value of poultry by making them more productive.

P. D.

Pisciculture.

878. **Pond Fertilising.**

DEMOLL, R. (Professor University of Munich). Teichdungung *Handbuch der Binnenfischerei Mitteleuropas*, Vol. IV. Stuttgart, 1925.

In this book, which for the first time comprises pond-fertilizing as an independent section, the studies on the importance of the soil for the problem of pond-manuring are of a special interest. According to DEMOLL and his collaborators, pond-water should not in the future be considered as a solution of pond-soil. The latter has its own chemistry and physics, and there also arise many differences between the methods of agricultural chemistry and those of the science of pond-manuring (chemistry of hydro-culture). Especial difficulties are found in the taking of samples. The soils employed for experiments in soil-manuring should not be very permeable to water and must not be acid. Moreover the changes must be taken into account which the pond-soil undergoes as a consequence of the introduction of spring or brook water. Thus in the course of years there is a tendency for an equilibrium to be established amongst different soils and the permeability of the soil diminishes as a consequence of the accumulation of settling colloids. The colloidal nature of an old pond-soil mud is considerably greater, according to BREEST and LANTZSCH, than that of the best arable soils.

The nitrogen content of non-nitrogenous pond-soils manured with phosphates, has proved higher than that of not manured pond-soils and exceeds that of all normal arable soils. According to LANTZSCH the nitrification is checked in the upper mud zone of the ponds but goes down to a soil depth of about 40-42 cm. Deep ploughing of pond-soils has not given good results, because a subsoil poor in organisms is brought to the surface. The necessary loosening of the soil is already brought about by

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the freezing of the pond soils in winter and by processes of fermentation which take place in early spring, and also by the organisms working upon the soil. Improvement of a "sick" pond soil is obtained by letting the soil lie fallow during the summer or by the agricultural use of the dry soil. Soils "tired", in the sense of pond culture, are more profitable for agriculture than normal arable soils.

The methods of valuation of pond-soils are dealt with in the new book. The value of soil appraisement on the basis of its capacity for fixing nitrogen is acknowledged, but the soil should only be valued after it has been adequately limed. The most suitable application of lime was found to be 5 000 kg. $CaCO_3$ per hectare. The latest results reported of pond soil liming are astonishing. While up to this time manuring experiments with 40 per cent potash salts gave no result. DEMOLL has of late obtained good yields with kainite and sulphate of potash and magnesia. Phosphoric acid is very strongly absorbed by pond soils, but BREEST found phosphoric acid in the water immediately above the soil, in a very dilute condition. The after effects of former manuring with phosphates have proved to be considerable.

Sulphate of ammonium has recently given good results.

Organic manures should not be closely spread over a pond soil, as they may easily cause an injurious consumption of oxygen. H. F.

FARM EGINEERING.

Hydraulics and Methods of Cultivation.

879. **Power for the Farms from Small Streams.**

DANIELS, A. M., SEITZ, C. E. and GLENN, J. C. *United States Department of Agriculture, Bulletin No.* 1430, pp. 34, figs. 40. Washington, D. C., 1925.

The purpose of the Bulletin is to acquaint farmers with the possibilities of developing the power of small streams by converting it into electrical energy, and the uses to which such power can be put. Information is given as to avoidance of unnecessary expense, the estimation of the available power of a stream, and sources from which additional information may be obtained in regard to approximate cost of installing a plant.

W. S. G.

880. **The Spacing of Crops.**

PRESCOTT, J. A. Bulletin No. 12. *Sultanic Agricultural Society*, pp. [illegible], tables 26, figs. 22. Cairo, 1924.

The author describes in detail experiments on the effect of spacing on maize, wheat and cotton.

In the competition between plants of the same kind, the volume of soil occupied by the roots may be considered as the principal variable factor affecting yield.

Another possible factor is apparently the effect of the crop on the production of nitrate in the soils, so that less plant food is available at the closest spacings.

Where the yield is built up over a period of time, as in the case of the flowering habit of cotton, or the tillering habit of wheat, the earliness of the crop is also affected; in the case of cotton with very important consequences on account of the pink bollworm attack.

On the whole, the best practical conditions are those which permit of as wide spacing as is possible consistent with yield, as this ensures economy of seed and ease in cultivation and harvesting.

W. S. G.

CURRENT NOTICES

Legislative and Administrative Measures.

881. **Chile : Regulations for the Sale of Nitrate of Soda.** — In reference to art. 14 of the regulations for the application of Law 98, of 14 November 1924, on the control of the sale of fertilisers, an article which enacts that Chilean saltpetre must not contain less than 95 % of nitrate of soda and not more than 2 % of sodium chloride, the "Junta de Gobierno" enacts that in the case of lower percentages of nitrate the market price of the fertilizer shall be reduced: one per cent for 94 % of nitrate, 3 % for 93 % of nitrate, 4 % for 92 %, 6 % for 92 to 91 % and 8 % for a percentage of 90. If the content of nitrate is less than 90 %, the reductions are to be doubled in each case proportionately. The fractions of a unit are to be calculated proportionately. (*Boletin de las Leyes y Decretos del Gobierno*, February 1925 and *Boletin mensual de la Asociación de Productores de Salnitre de Chile*, Vol. VII, No. 74, 1925).

882. **Chile : Regulations for Advances of Seeds.** — This regulation has been passed for the application of the Decree Law No 851 of 12 February. The Department of Agricultural Services (*Dirección General de los Servicios agricolas*) through the medium of the Publicity and Propaganda Service (*Servicio de Divulgación y Propaganda*) and with the assistance of the provincial and departmental agricultural experts and of a Committee appointed for the purpose, has drawn up a list of small cultivators, owning not more than 100 hectares of land and growing wheat and barley, who require advances of seeds for sowing and who reside in the departments extending from Serena, on the north, to Vichuquen, on the south, for the coast zone, including certain sections of the departments of Combarbala, Putsendo and Melipilla, and if required other departments or sections to be designated by the Minister of Agriculture.

The regulations contain detailed provisions for procedure in the case of advances of seeds. The seeds will be supplied by the special Committee mentioned in the law, and the seeds must satisfy the following conditions: minimum purity, 27 %; germination, not less than 95.5; weight per hectolitre, not less than 70 kg for wheat and 68 kg for barley. The analyses are carried out by the Service of Plant Hygiene (*Servicio de Policia Sanitaria Vegetal*) and the *Servicio de Divulgación y Propaganda* is responsible for inspection. (*Boletin de la Sociedad Agricola del Norte*, Year 13, No. 2, La Serena, 1925).

883. **Esthonia : Importation of Live Cattle and Animal Products.** — These imports must be accompanied by a certificate given by a veterinary

practitioner of the exporting country, appointed officially by the Government in question. The certificate must state that the import to which it refers comes from a country where no case of infectious disease of cattle has been reported during the last fortnight. In the case of non-observance of this regulation the Service of Control of Animal Hygiene of Esthonia may send back the cattle or animal products respectively, which it is desired to import, to the country from which they come, or even, in more favourable circumstances, may order the quarantine of the animals and the disinfection of the products in questions. (*Communication of the French Legation in Esthonia to the French Ministry of Commerce and Industry*). (Appendix to No. [illegible] 3 of the *Moniteur officiel du Commerce et de l'Industrie*).

884. **Belgium and Luxemburg : Excusing of Certificate of Origin in the case of the Superphosphates of the Economic Customs Union of Belgium and Luxemburg imported into France.** — Following on the conclusion of the commercial agreement between France and the Economic Customs Union of Belgium and Luxemburg, signed at Paris on 4 April [illegible], there are included in the list of the goods excused the certificate of origin at the time of their export from Belgium and from Luxemburg into France, superphosphated originating in the Union above mentioned, if imported in sacks bearing manufacturers marks, from either Belgian or Luxemburg. — The French Customs Department reserves the right to obtain legal advice when there is occasion to suspect the origin of the superphosphates.

885. **France : Supervision of the Production of Silkworm Eggs.** — By the Decree of 25 May 1925, which modifies preceding decrees, the establishments for production of silkworm eggs must give notice to the Ministry of Agriculture, Office of Agricultural Information (*Office des Renseignements agricoles*) of the particulars relating to their commercial and industrial standing (entry number on the Register of Commerce, office address, exact location of the establishments, etc.). The importers of silkworm seed must give the proper notice to the inspector of the supervision service at Draguignan of their name and address, the place where the imported seed is stored, its total weight, the number of the packages of the different kinds. The inspection service shall proceed to the proper examinations and shall subsequently affix a suitable mark to the actual packages which contain the seed, which is to be placed on the market. (*Journ. Off.*, May 1925).

886. **Ivory Coast : Control of cotton, rubber, rice, kola nuts and bird lime.** — In the *Journal Officiel de la Cote d'Ivoire* March [illegible] there are published the Governmental Decrees establishing control of the sale, purchase and export of these products.

887. **French West Africa : Breeding of Merino Sheep in the Haute Volta.** — A provisional grant of land has been made by decree to the Tourcoing Chamber of Commerce for the purpose of breeding merino sheep. The land is about 500 hectares in area and is situated to the east of the [illegible] (district of Cuahigouya). (*Journal Officiel de la République française*, 9 January 1925).

888. **Latvia : Fund for Seeds.** — A fund of 500,000 lats has been instituted with a view to obviating any shortage of seeds and to improving their quality. Selected seeds are to be supplied to cultivators in the form of advances, such

seeds being suited to the climatic conditions of Latvia. In the event of there being an insufficiency of these seeds, seeds of ordinary quality are supplied instead, which must however satisfy certain requirements made by the Ministry of Agriculture. Seeds purchased with the fund so set aside are distributed in the first place to the owners of recently formed holdings, then to the small cultivators and the bee-keepers who were ruined by the war. The fund for the seeds is intended also to meet any shortage of seed due to poor harvest, damage from hail, etc.

The Ministry of Agriculture has the administration of this fund and fixes each year for every farm holding the quantity of seeds which it has the right to receive. Besides repaying the cost price of the seeds (including the cost of transport, etc.) the farmer has to pay 2 % of the price so as to secure the stabilization of the fund. Individual advances of seeds can only be made for a period of one year in the case of spring sowings and of 18 months for the autumn sowings. (*International Institute of Agriculture, Legislative Texts* No. 5, 1925).

889. **Luxemburg: Importation of Oats for Sowing.** — The Grand-Ducal Government, Department of Commerce and Industry, issued last spring the following instructions for the services subsidiary to the Customs: 1. the importation of oats for sowing is limited to the first four months of the year; 2. the oats must be in bags sealed with the seal of the producer and of the agricultural organization to which he belongs, and must be accompanied by a certificate of origin, placed inside the bag, stating that the contents are selected seeds. This certificate of origin is not merely a Customs formality, but is to be given by the Seed Selection Stations. (Communication made by the French Ministry of Commerce and Industry. Appendix to No. 13 of the *Moniteur Officiel du Commerce et de l'Industrie*, 1925).

890. **Rumania: Testing of Seeds of Forage Plants.** — Regulations have been issued for the application of the law to the trade in seeds of forage plants belonging to the families of the Leguminosae and of the Gramineae. The testing is carried out by the Bucharest Central Agricultural Station, by the Agricultural Station of Cluj, by that of the North and by any other stations to be set up by the Ministry of Agriculture and Public Lands. The conditions which must be fulfilled by seeds for marketing relate to purity, germinative power, freedom from dodder, kind and variety, place of origin. A maximum of 2 % of foreign bodies is tolerated. The tests for germination, which are carried out on 100 grains of pure seeds, must be continued for 10 to 12 days in the case of white clover and alsike and for the grasses *Lolium perenne*, *Lolium italicum* and *Phleum pratense*: ten days for red and crimson clover and lucerne, and from 15 to 27 days for the other seeds.

Seeds may only be placed on the market in sound bags accompanied by a certificate of analysis, and in the case of clover seeds, or seeds of lucerne, *anthyllis vulneraria*, *lotus corniculatus* and *phleum pratense*, also sealed. Seeds left unsold at the end of a year must be subjected to fresh tests.

The regulations in question refer to the measures concerning the procedure to be followed for seed testing, both on the side of the agricultural stations, and on that of the seller and the purchaser. In order to secure the destruction of dodder in the fields, State supervision of the forage crops in question has

been established; the inspections take place at least twice a year, viz. after the first cutting and during the autumn. The owners of crops of lucerne, clover, etc. are obliged to destroy the areas infected with dodder.

The importation of forage seeds not first subjected to the analysis of the Bucharest Agricultural Station is forbidden and these imports are as a rule limited to the Customs Offices of Halmi, Timishozsa, Arad, Chica Voda, Galatz, Sibiu, Costanza, Bucharest. The regulations lay down the procedure to be followed in such cases, and the penalties for contravention of the provisions. (*Correspondance économique roumaine*, Year VII, No. 11).

891. **Rumania: The New Wheat Flour and Bread Regulations.** In accordance with the orders issued by the Rumanian Government in February last to meet the requirements of bread-making, rye, barley and their derivatives were stated to be articles of prime necessity for the feeding of the population and in consequence their export was forbidden. The mayors of the urban communes were empowered to authorize the making of bread with white wheat flour mixed with the flour of potato, rye, maize, barley, and moreover in case of need to fix the days of the week on which the feeding of the population was to be secured by means of maize flour. The price of rye and its derivatives was fixed by the Government, while that of barley and barley flour was left free. (*Journal*, No. 600, February 1925 and *Correspondance économique roumaine*, Year VII, No. 1, 1925).

892. **Rumania: Institution of Agricultural Chambers.** — Departmental Agricultural Chambers have been instituted in Rumania by a special law, with headquarters in the chief towns of the districts, and grouped into a "Union of Agricultural Chambers" with headquarters at Bucharest. They are public institutions, founded for the purpose of representing and safeguarding the interests of agriculture, forestry and stock breeding in their various branches, and of contributing in every way to the increase of production in the various spheres, whether of agriculture, forestry or stock breeding. The Law which relates to these Chambers is divided into eight chapters: foundation and objects; constitution of the district Chambers; constitution of the Union of the Agricultural Chambers; organization of the Chambers; budget and management; general provisions; temporary provisions. (*Correspondance économique roumaine*, Year VIII, No. 1, Bucharest, 1925).

Experiment Stations and Agricultural Instruction.

893. **Germany: Experimental Stations at Lauchstadt and Gross-Lubars.** — Prof. W. SCHNEIDEWIND has compiled in collaboration with Drs. F. MÜNTER and J. HAHNE and the administrator W. GROHLER, two detailed reports on the activity, during the period [illegible] to [illegible], of these two experimental stations, belonging to the Agricultural Chamber of the Province of Saxony. The reports deal with numerous enquiries on fertilising and cultivation experiments (wheat, barley, oats, lupins, peas, kidney beans, potatoes, sugar beets, etc.). The work contains a large number of tables [illegible].

(Prof. Dott. W. SCHNEIDEWIND. Neunter Bericht über die Versuchswirtschaft Lauchstadt und zweiter Bericht über die Versuchswirtschaft Gross Lubars. *Landwirtschaftl. Jahrbücher*, Vol. LXI, [illegible] Berlin, 1925).

894. **Germany: Experimental Forestry Institutes.** — On 24-25 March 1925, after 12 years interval, the association of these institutes (*Verein der Deutschen forstlichen Versuchsanstalten*) resumed its meetings at Weimar. The last general meeting had been held at Neustad on the Hardt in 1913. At the present meeting representatives were present of the experimental institutes of Bavaria, Prussia, Saxony, Baden and Hesse. Apologies were made for the absence of representatives of those of Wurttemberg and of Brunswick. Thuringen does not yet possess a forestry institute. The next general meeting will be held in the spring of 1926, probably at Konigsberg. (*Forstwissenschaftliches Centralblatt*, Year 47, No. 11, Berlin, 1925).

895. **Germany: Courses in Rural Mechanics in Bavaria.** — The Bavarian Government about ten years ago instituted agricultural chambers in various places (*Landwirtschaftsstellen*), which encouraged agricultural progress and served as advisory bodies for agriculturists. There are at the present time 98 of these organizations, including in round figures 200 special advisers who act under the Bavarian Ministry of Agriculture. The Ministry in 1920 arranged that the *Landwirtschaftsstelle* should hold, so far as possible every year, courses of practical rural mechanics for the benefit of the cultivators of small and average sized holdings, adapted to local requirements in each case. Accordingly, the Ministry of Agriculture merely laid down in this connection the main outline of the scheme, leaving it to the *Landwirtschaftsstelle* to carry out the special applications in the different courses. Side by side with the theoretical instruction on farm implements and machines, care is taken to give the students practical acquaintance with their working, the putting together and taking apart of the machines and their separate parts. The courses are accordingly held in connection with visits to an agricultural machinery factory and a large repairing workshop, etc. where expert foremen give practical illustrations to the students as required. A visit to some large farm completes the courses.

So as to ensure success not more than 15 to 20 persons are admitted to the courses and in case of need, the courses are repeated with the same students. As a general rule, the instruction lasts for a week, usually fixed for the second half of May, a time when farmers are relatively at liberty. The following are the statistics of attendance, etc., for the years 1921-22-23-24. In 1921 32 courses were held by 27 *Landwirtschaftsstellen*, attended by 570 students; in 1922, 57 courses by 47 *Landwirtschaftsstellen*, attended by 815 students; in 1923, 70 courses by 58 *Landwirtschaftsstellen*, attended by 1315 students; in 1924 there were held 59 courses, arranged by 51 *Landwirtschaftsstellen* with 1058 students. (Fr. LANG: Landwirtschaftliche Maschinenlehrkurse in Bayern, *Münchner Neueste Nachrichten*, 17 June 1925).

896. **Austria: The Fiftieth Anniversary of the Experimental Forestry Institute of Mariabrunn.** — The separate official existence of an Experimental Department for Forestry (*Versuchsleitung*) in Austria dates back to 9 July 1874 when by decree of the Ministry of Agriculture in Vienna there was appointed a temporary director for forestry enquiries, and by the subsequent Imperial order of 2 August 1874 the whole subject was brought under regulation. The first Director for Experimental Forestry (*Leiter des forstlichen Versuchswesens*) was Prof. ARTHUR Baron VON SECKENDORFF-GUDENT, who was already since 1868 a member of the Forestry Academy of Mariabrunn,

and who in the twelfth year of his holding of the post of head of the Department (1874-1886) had as collaborators F. A. WACHTL, J. MOLLER, V. HOHNEL, O. SIMONY, V. THUMEN, W. VELTEN, N. BOHMERLE, A. CIESLAR, and others The activity of this highly competent group of persons took the form of over 100 scientific works, published partly in the *Mitteilungen aus dem forstlichen Versuchswesen Oesterreichs* partly in the *Centralblatt für die gesamte Forstwissenschaft.*

After the death of SECKENDORFF which took place on the 29 November 1886, the Chief Forest Councillor LUDWIG DIMITZ was appointed *Versuchsleiter*, but on being subsequently transferred to take charge of the Technical Forestry Service in the Ministry of Agriculture, he was replaced (December 1888) by JOSEF FRIEDRICH, also Chief Forestry Councillor. Under FRIEDRICH, the *Versuchsleitung* was transformed in April 1891 into an Experimental Forestry Institute (*Forstwirtschaftliche Versuchsanstalt*) and the work was carried on by the director in conjunction with WACHTL, CIESLAR, BOHMERLE the future successor of FRIEDRICH, A. SCHIFFEL, HOPPE, N. v. LORENZ, F. v. RUŠNOV, HADEK, JANKA, W. SEDLACZEZ, ZEDERBAUER. SCHIFFEL who held the direction of the Institute from 1908 to his retirement in [illegible], was succeeded temporarily by HADEK and then by KUBRIKA till the outbreak of the war: during the war H. LORENS LIBURNAN was elected to the post, and after 1918 when the Institute of Mariabrunn was no longer part of a great State for that reason and from other circumstances it began to undergo certain changes in its constitution. After the directorship of JANKA (1919-1922) and in consequence of the appointment of ZEDERBAUER to the Vienna Higher School of Agriculture (Hochschule fur Bodenkultur) the vacant post was not filled and from that time the direction has been carried on by an official of the Institute. In the fifty years of its existence, the Mariabrunn Forestry Institution has published about 400 scientific works. (*Centralblatt f. d.* [illegible] Year 50, Parts 7-12, Vienna and Leipzig, 1924).

897. **Belgium: The Mechanical Laboratory of the Non-State University of Solbosch, Brussels.** — In consequence of the munificence of the family of ERNEST SOLWAY, the course of study, which leads to the new degree of Electro-technical Engineer, will be completed by experimental researches. The object of the new laboratories will be threefold: 1. to enable the students to acquire the necessary practical knowledge of technical measurements under the conditions in which they will be found in industry: 2. to facilitate the systematic study of the machines and to make possible a thorough [illegible] with their working; 3. to make it possible to undertake, side by side with the teaching exercises, research and experimental work, suggested by engineers and builders, which may offer scientific interest or some new feature.

The equipment of the laboratory will include four groups of installations: Heat technique; Thermo-mechanics; Hydraulics and Mechanics [illegible] Dynamometry and General Mechanics (*Revue* [illegible] Vol. VI, No. 4, 1295).

898. **Brazil: Agricultural Experiment and Instruction during 1924.** — Experimental Stations. — The General Experimental Station of Campos (*Estação Geral de Experimentação*) is pursuing its [illegible] the varieties of sugarcane. By hybridization [illegible]

ties have been obtained up to the present, many of which have been rejected others are under investigation and some are being cultivated for subsequent distribution among planters. Research has been made on the sugar content and purity of the juices of the different varieties and the influence of fertilisers in this respect is being demonstrated. Experiments on the " Uba " cane, the resistance of which to certain diseases, mainly to " mosaic ", is well known have led to the obtaining of valuable varieties, with longer internodes and larger diameter than the species from which it originates.

The abnormal situation in Rio Grande do Sul makes it difficult for the work of the General Experimental Stations to be extended more than in past times.

The " Section of the Sugar yielding and Oil yielding Plants " of Conceição do Arroio has at its disposal a million square metres of which 225,000 are pasture land and the remaining are under cultivation of various kinds, especially sugarcane. In the year 1924, no less than 3,308,410 seedlings of sugarcane were distributed.

The Alfred CHAVEZ Wheat Section has harvested in all, 20,742 kg. of selected wheats, rye, oats, barley.

The Goytacazes Experimental Station is in process of final organization.

Botanic Garden. — Researches were continued, in the Botanic Garden, on the flora of the country, with special economic objects and excursions taken when necessary to the more interesting districts in this respect. A careful survey has been made of the Amazon region, from the point of view of its climatology and ecology as well as the botany. A large number of living specimens and seeds have been brought back to the Botanic Garden, and valuable results obtained. Great advantage will result from the formation of smaller botanic gardens in the different States with the view of proceeding to the planting and cultivation of regional kinds of plants of economic value, and especially of those threatened with extinction. The Botanic Garden, in 1924, distributed a large quantity of plant specimens and 423 kg. of seeds.

The Biological Station of the Forest Reserve (*Estação Biologica da Reserva Florestal*) of Itatiaya has made progress in carrying out its programme of work and enquiry relating to the flora of the mountainous regions, especially in regard to forestry.

From year to year there is an increase in the exchange of publications, seeds, vegetable products, etc., between the Botanic Garden and other institutions of the kind, European and American. The Garden issues its own records on its original and unpublished work on the Brazilian flora.

Higher School of Agriculture and Veterinary Medicine. — The school has not yet the use of adequate land for demonstrations and experiments and hence is unable to carry out all its practical work.

Barbacena Sericultural Station. — This institution also is in need of a larger area and more plants. In 1924 it distributed 51,755 mulberry plants and 1567 grammes of silkworm seed.

Propaganda by means of co-operative Research. This is carried out by the Department of Agricultural Development (*Directoria do Fomento Agricola*). The farmer's share in the co-operation is the land,

the management, the labour, the live stock, etc. and that of the Government includes the machines, seeds, fertilisers, insecticides, etc. as well as expert assistance. The crop is solely for the benefit of the farmer ". (N. D. K.) There are 138 of these plots, working under the Ministry of Agriculture, with a total area of 721 hectares, and distributed as follows: Amazonas, 4; Pará, 5; Maranhão, 4; Pianhy, 3; Ceará 9; Parahyba, 3; Pernambuco, 2; Alagoas, [illegible]; Sergipe, 5; Bahia, 4; Espirito Santo, 3; Rio de Janeiro, 21; Minas Geraes, 10; San Paolo, 21; Paraná, 3; Santa Catharina, 6; Rio Grande do Sul, [illegible]; Goyaz, 5; Matto Grosso, 7; Territorio do Acre, 2.

Agricultural Apprenticeship Courses. — These apprenticeship courses (*Aprendizados agricolas*) have been in regular working at Barbacena and Satube. The pupils on leaving readily found post at the agricultural inspectorates of the different States. At the Joazeiro courses 1072 plants were distributed, nearly 16 kg. of seeds and 990 layer shoots of vines of different varieties. During those held at São Francisco there were carried on cultivations of millet, sugar cane, rice, beans, tobacco, cassava, sweet potato, banana, etc., large quantities of seeds being also distributed to those taking part. On the other hand the courses at S. Luiz das Missões have not been held regularly, on account of the revolutionary situation in Rio Grande do Sul. (Mensagen apresentada ao Congresso Nacional na abertura da segunda sessâo da decima segunda legislatura pelo Presidente da Republica ARTHUR DA SILVA BERNARDES, 1925. *Diario Official*, May 1925).

899. **Bulgaria : A New Stock Breeding Station.** — The Sofia Departmental Council has organized this new station, for which the bishopric of Sofia has granted the buildings of the former monastery of Chiiakovo. There will be established a depot for stock breeding, an experimental farm and a farm for the production of different seeds of agricultural value. (*La Bulgarie*, Year [illegible], No. 573, Sofia, 1925).

900. **China : The Ling Nan Agricultural College, Canton.** — *The Lingnaam Agricultural Review*, Vol. II, No. 2, 1925, contains an account of recent work carried out by the Ling Nan College in animal husbandry, agronomy, horticulture and sericulture. Rice is being closely studied and over [illegible] varieties of this cereal have been introduced from the United States, the Philippines, Java and Japan. Allusion is made to the insecticide DERRIS, known as tuba root in the Straits Settlement; near Macao gardens are kept free of insect pests by the use of this insecticide; the College has obtained about [illegible] plants in order to study its properties.

901. **China : The College of Agriculture and Forestry, University of Nanking.** — The tenth annual report of this College states that there has been a large increase of teachers, associates and assistants. All investigation work, both scientific and practical, has been considerably extended. The annual grant of 5000 dollars from the Shanghai Forestry Fund Committee has been renewed for another period of three years. An agricultural and forestry periodical has been successfully published. Equipment for class, laboratory and field use has been added. The year's work in sericulture, cotton and [illegible] improvement has been highly successful, and direct contacts with the farmers have been greatly increased.

The University of Nanking through the College of Agriculture is pressing

for ward its ten years' famine prevention programme for which it has a fund of 675,000 gold dollars, allocated by the American Committee for th eChina Famine Fund of New York.

This College has now eleven departments: Agricultural Economics and Farm Management, Agricultural Gardens, Agronomy, Bacteriology, Botany, Cotton Improvement, Forestry, Plant Pathology, Rural Education and Sericulture. (*The Lingnaam Agricultural Review*, Vol. 2, No. 2 Canton, 1925).

902. **China: Agricultural Education at Peking University (Yenching).** — The Department of Agriculture is now well organized and in the 1924-25 programme courses were announced in the sections of Agronomy, Horticulture, Agriculture, Animal Husbandry, and Poultry Husbandry. Additional courses are offered in problems of Chinese country life and sources of agricultural information. Students taking these courses are eligible for the Degree of Bachelor of Science. Yenching is especially interested in animal industry, and pure-bred beef and dairy cattle are being imported from America. Professor Bransford Eubank, a graduate of the Texas Agricultural and Mechanical College, is to take charge of this work. (*Lingnaam Agricultural Review*, Vol. 2, No. 2. Canton, 1925).

903. **United States: Annual Report of the Agricultural Experiment Stations, University of Louisiana, 1923.** — The field work at Audubon Park has been transferred to Baton Rouge where about 100 acres are available for sugar cane studies. Experiments were made on cane land with a new " clover ", *Melilotus indica*, which provided 107 lb. of nitrogen in the soil per acre. A very severe outbreak of borers was experienced in the cane fields; attempts to render the egg parasite of the moth borer more efficient were unsuccessful. The tachnid introduced from Cuba was found on 16 plantations, but no effect on the prevalence of borers was observed. Dipping canes into water heated to 50°C. proved effective against the moth borer and the mealy bug; no harm was caused to the buds of the cane when they were in the resting condition. Moth borer caterpillars were found feeding on several species of wild grasses.

Moulds responsible for deterioration of sugar in storage were found to be susceptible to carbonic acid gas, and the introduction of a non-sporulating yeast Toruba, which gives off quantities of this gas gave satisfactory results.

904. **United States: Tropical Plant Research Foundation.** — The Tropical Plant Research Foundation is an organization formed under the auspices of the National Research Council and incorporated on June 6, 1924, under the laws of the District of Columbia governing societies for scientific and similar purposes. The objects of this foundation are to promote research for the advancement of knowledge of tropical plants and crops; to conduct investigations in plant breeding, agriculture, horticulture, forestry, agricultural entomology and plant pathology, and to publish the results thereof; it is also empowered to establish and maintain such temporary or permanent stations and laboratories as may be necessary for the accomplishment of these objects.

As a result of a conference of foresters and officers of the Pan American Union, held on 29 October 1924, the Foundation has been commissioned to collect all available information relative to the forests of Latin America as a preliminary step towards a Pan-American Forestry Conference, and the outlining in a definite manner of the problems of tropical forestry.

The central office of the Foundation is in Washington. The laboratory headquarters in the United States will be at the Boyce Thompson Institute for Plant Research, Yonkers, N. Y. The administration of the Foundation is vested in a board of nine trustees, four of whom represent business interests while five must be scientific men. The foundation will work on a project basis definitely organized in turn for each particular problem, such, for example, as the diseases and insects of sugar cane in Cuba, and will provide a research service for tropical plant industries.

The following bodies will be represented on the board of trustees by one member in each case, the National Research Council, the American Phytopathological Society, and the American Association of Economic Entomologists. The foundation will be supported by funds contributed by individuals or organizations interested in tropical plant products.

The Foundation is to assemble records of the researches already carried out and to compile special indexes and bibliographies. There will be established a personal register of scientific men who are particularly equiped for tropical service. The scientific staff is at present composed of the following members: Entomologist, Prof. D. L. VAN DINE; assistant entomologist, Mr. C. F. STAHL; Phytopathologist, Dr. JAMES A. PARIS; assistant pathologist, Mr. Marion N. WALKER; chemist and soil biologist, Dr. R. V. ALLISON. The advisory committees are: the Division of Biology and Agriculture, National Research Council, the Advisory Board of the American Phytopathological Society, the Committee of Policy of the American Association of Economic Entomologists, and the Executive Committee of the Cuba Sugar Club.

The President of the Board of Trustees is Prof. L. R. JONES, head of the Department of Plant Pathology, University of Wisconsin; the Vice President, Prof. R. A. HARPER, Torrey Professor of Botany, Columbia University, New York, and Chairman of the Committee on Biology and Agriculture, National Research Council. As Scientific Director and General Manager has been elected WILLIAM A. ORTON, ex-pathologist in charge, Office of Cotton, Truck and Forage Crop Disease Investigations, Bureau of Plant Industry, United States Department of Agriculture. (*Bulletin of the Pan-American Union*, Washington, D. C. January, 1925).

905. **United States: Study of Ornamental Plants.** — The San Fernando Nursery Company, of San Fernando, California, has established a department of plant research, for the purpose of studying problems of identification, propagation and improvement of ornamental plants. The work has been placed under the direction of Dr. ARTHUR HOUGHTON of the University of California. (*Science*, Vol. LXI, No. 1575, 1925).

906. **United States: Research Fellowship in the Chemistry of Perfumes and Essential oils.** — Through the generosity of Messrs. [illegible] MEYER and LEONHARDT, president and vice president of Fritzsche Brothers, a fellowship for research in the chemistry of perfumes and essential oils has been offered to Columbia University. The fellow is to be appointed by the University Council upon nomination of a committee of award composed of the president of Fritzsche Brothers and the senior professor of organic chemistry at Columbia, and approved by the department of chemistry. The recipient of the fellowship will receive [illegible] dollars per annum and [illegible]

conducted under the direction of Professor MARSTON T. BOGERT (*Science*, Vol. LXI, No. 1578, 1925).

907. **United States : Conference on Gardening.** — Dr. A. C. BEAL, Professor of floriculture in Cornell University, delivered last spring a series of six lectures on " The history of gardening and the use of flowers " before the Horticultural Society of New York and the Garden Club of America at the American Museum of Natural History, New York. (*Science*, Vol. LXI, No. 1580, 1925).

908. **United States : University of Michigan Biological Station.** — This Station held its session for instruction and research from 22 June to 14 August on the shores of Douglas Lake, Cheboygan Country, Michigan. The courses in zoology included : ichthyology, limnology, entomology, ornithology, herpetology and mammalogy ; those in botany : taxonomy of green cryptogams, taxonomy of the briophytes, systematic botany, ecology, plant anatomy and plant geography. The various lines of research were directed by : Prof. CARL LA RUE (University of Michigan) for the morphology, taxonomy and life histories of parasitic worms ; Dr. CH. CREKEAS (College of the City of Detroit) for fishes and mammals ; Prof. P. S. WELCH (University of Michigan) for aquatic insects and limnological problems ; Dr. F. BLANCHARD (University of Michigan) for birds, amphibians and reptiles ; Prof. HUNGERFORD for aquatic hemipters ; Prof. G. E. NICHOLS (Yale University) for the bryophytes ; Prof. GATES (Kansas State Agricultural College) for plant physiology and ecology ; Prof. EHLERS (University of Michigan) for the taxonomy of the flowering plants. (*Science*, Vol. LXI, No. 1575, 1925).

909. **Transfer of the Collection of Type Cultures of Bacteria of the American Museum of Natural History to the McCormick Memorial Institute of Chicago.** — This large collection of type cultures of bacteria established at the American Museum of Natural History by Dr. C. E. A. WINSLOW, and more recently maintained at the Army Medical Museum by the Society of American Bacteriologists has been transferred to the McCormick Memorial Institute in Chicago. This has been made possible by a grant secured by the National Research Council from the General Education Board, which provides for the maintenance of the collection for a period of five years. The general supervision of the collection is vested in a committee representing the Society of American Bacteriologists, the Society of Pathologists and Bacteriologists, the American Phytopathological Society, the American Society of Zoologists and the McCormick Memorial Institute. The committee hopes to enlarge the collection, and eventually to include fungi, moulds and other microorganisms, as well as a comprehensive collection of bacteria. A catalogue will be issued as soon as possible. (*Science*, Vol. LXI, No. 1572, 1925).

910. **United States : Livestock Experiment Station, Miles City, ontana.** — By Act of Congress in April 1924, 55,000 acres of grazing land and 2000 acres of irrigated land, situated in Miles City and formerly occupied by the Fort Keogh Military Reservation, was transferred to the U. S. Department of Agriculture. This area together with the buildings already put up and 75 miles of fencing is now the property of the livestock Experiment station and under the immediate supervision of the Animal Husbandry Division of the Bureau of Animal Industry, with the co-operation of the Montana Expe-

riment Station and other bureaus and divisions of the department interested in livestock problems. Plans have been made to maintain an initial herd of 1000 beef cattle, and a stock of sheep, hogs, horses and turkeys (*Science*, Vol. LXI, No. 1575, 1925).

911. **Research on the Applications of Electricity to Agriculture.** — The question of the use of electricity on the farm is one of importance in view of the advantages of this source of energy. However as regards rural needs, the cost of production is often a relatively small item as compared with the cost of transmission, distribution and transformation. One of the chief difficulties is that the consumption of electrical energy by the average farmer is relatively small. To establish an electrical service the agricultural uses of electricity must be increased, so that a rate can be charged which will be advantageous both to the central station and the farmer.

The following are some of the chief applications of electricity in agriculture : lighting, heating, in the canning of fruit and vegetables and the making of preserves, the dehydration of fruits, the electrical treatment of seed, the stimulation of crop production, increase of egg production, heating of incubators, spraying and heating of orchards to prevent injury by frosts, and as a source of power, both for ploughing and cultivating and for the many machines in use on a farm.

The variable results obtained so far indicate that not enough is yet known about the main factors. The use of electricity generally in farm operations will probably come about from the development of the use of smaller power units.

The scientific application of electricity to agriculture requires a large amount of fundamental agricultural research and also of engineering experimentation, to ascertain power requirements and exact electrical applications (*Experiment Station Record*, Vol. 51, No. 4, Washington, 1924).

912. **France : Experimental Work in Olive Cultivation, etc.** — J. BONNET, Regional Professor of Oleiculture gives a summary in the *Bulletin de l'Office de Renseignements agricoles* (No. 9, 1925) of the results obtained in the period 1923-25 in the centres of experimental olive cultivation and in the French co-operative oil manufacturies with experiments on olive trees with complete fertilizing, comparative experiments in annual and biennial prunings, the use of baskets of alfa fibre, coconut fibre or of metal receptacles, the effect of adding hot water to the olive oil residues, the effect of the autumnal frosts on the rich flavour of the olives, the picking of the olives the effect of using oil of almonds in the treatment of the olives, the various operations connected with the pressing apparatus, and experiments with the oil extracted from wine lees.

913. **France : Valuable Collections belonging to the "Laboratoire d'Agronomie coloniale" (Paris) destroyed by Fire.** — A fire which broke out on the night of 6 June last has destroyed the valuable collections and documents belonging to the "Laboratoire d'agronomie coloniale", which is under the direction of Prof. AUG. CHEVALLIER. The herbariums which contained some very rare plants and flowers have been reduced to ashes as also the collection of valuable colonial timbers, and in addition more than [illegible] treatises and manuscripts collected during a period of thirty years.

914. **France: The Centenary of the Nancy National School of Waters and Forests.** — *L'École nationale des eaux et forêts* of Nancy, must be regarded as one of earliest of the kind, having been inaugurated on 1 January 1825, in virtue of a Royal Order of 26 August 1824. At that date only three institutions of the same type were in existence: that of Mariabrunn in Austria, founded in 1813, of Aschaffenburg in Bavaria (1820) and of Hohenheim in Wurtemberg (1820). The history of this school has been given in a book by Prof. CH. GUYOT, its former director (CH. GUYOT: *L'enseignement forestier en France. L'École de Nancy.* Nancy, 1898). In 1825 the first director of the school was an expert of great repute in forestry, LORENTZ, who was also for many years the only professor. When he was made administrator of forests at Paris, his place at Nancy was taken by DE SALMON, who was succeeded in 1838 by PARADE, the son-in-law of LORENTZ, who remained in office for nearly 26 years, and gained the reputation of being one of the greatest forest experts in France: on his death, which occurred in 1864 NARQUETTE was elected as director, and was succeeded in 1880 by PUTCH. The subsequent directors were BOPPE, GUYOT, and VIVIER and at the present time GUINIER.

The Forestry School of Nancy has the use of its own forests for the practical training work of the students. It has exclusive rights of enjoyment of those in the Vosges, in the Pyrenees and also in other parts and for a total area of some thousands of hectares. The students are boarded during the time of their studies and have to reside in the school buildings. They receive a compulsory military training and on leaving the school, are regarded as State functionaries with a right to pay. (*Journal Forestier Suisse*, Year 76, No 7, Berne, 1925).

915. **France: Instruction in Poultry Keeping.** — In an article, entitled *Nécessité de l'enseignement avicole*, which appeared in the *Revue Avicole* of last May, Ch. VOITELLIER, Professor at the *Institut National Agronomique*, explained the bases on which modern instruction in poultry keeping should be given in France. After having dealt with the present state of French poultry production, taking it in comparison with the production of the other European countries, and after suggesting the principal methods for its improvement and increase, he gives the main heads of the essentials of a regional instruction in poultry-keeping. In addition to the study of the early methods known to many people but not enough known in the country districts, of natural hatching of special incubation, of breeding, of fattening, he advises attention to the following: The management of country poultry yards, based on the utilization of hens which have a high egg-laying capacity; the elimination of the poor layers, the introduction of fowls that satisfy the conditions necessarily imposed for egg-laying, during the bad season; feeding on the lines required for the needs of laying hens: selection based on the use of the trap-nest, on production tests, as also on egg-laying; the weeding out of fowls i. e. the getting rid of the poor layers, choice of favourable times for the hatching according to the different breeds; the rearing of pullets with a view to egg laying; the production of non-fertile eggs for purposes of consumption; the methods of obtaining a high percentage of fertility in selected breeders; the value of the breed and the results of selection among families with a maximum egg-laying capacity; employment

of different systems of incubation and rearing: production of ducks [illegible]; principles of feeding according to district; disinfection procedure; treatment of infectious diseases.

Prof. VOITELLIER further considers it essential that every experimental stock-breeding centre should have a poultry-keeping scheme and in default of this that centres should be formed of experimental poultry keeping. The co-ordination of the results of the experiments and of the inquiries undertaken at these centres of investigation should be effected by a higher technical office which would serve as a link between the Department of Agriculture and the holders of the chairs of applied sciences whether of the Institute of Agronomy, the national schools of agriculture, or the veterinary schools. It is also essential that the professors and lecturers should be able to point to practical examples of poultry yards managed in accordance with the principles they are advocating. Professor VOITELLIER finally urged that attention should be given to the training of instructors specialized for the teaching of poultry management, on the lines of the diploma of *Conférencier avicole*, or Poultry Adviser as in England, Belgium or Denmark, and that use could be made also for such a purpose of the mistresses in charge of the household management instruction in the country districts. (*La Revue avicole*, Year 5, No. 3, 1925.)

916. **France: Experiments in Sericulture.** — The Director of the *Station séricicole du Var* has published a report on the enquiry into the silkworm breeding carried out in 1923-24 by the *Station séricicole de Draguignan et [illegible]sements en dépendants*. Researches have been made on the basis of the Mendelian law and with the result that after a year of strict selection breeding there has been a considerable improvement in the yield in spinning and in the quality of the silk. Other enquiries into the comparative value of leaves of mulberries grafted or otherwise went to prove the superiority of the former both for rearing the worms and as regards yield per tray. In addition comparative experiments have been made in rearing with the mulberry branch as compared with the separate leaves, as practised in Italy by the Lombard and the Friulian systems respectively. Rearing on the branch according to the results obtained in the Draguignan Station, cannot be usefully practised except in districts where the foliage is abundant and the trees are not exposed to frosts, while it cannot be in any way recommended in districts where silkworms are reared for reproduction from seed, in which there is a general shortage of foliage and when healthy and strong cocoons are wanted. Mme. BECU, the directress of the Luc *Station expérimentale de grainage* who had undertaken similar researches on the suggestion of BRANDI, concurs with these results. It is the opinion of this lady that in districts where breeding is carried on for the silkworm seed industry rearing on separate leaves is preferable, while rearing on the branch may be useful for the production of cocoons for spinning. (*Bulletin de l'Office de Renseignements agricoles*, No. 9, 192[illegible].)

917. **France: Diploma of Expert Producer of Silkworm Seeds.** — Following on the resolution of the French Union of Producers and [illegible] of Silkworm Seed, at its meeting on 26 March [illegible], the Minister of Agriculture by decree of 28 April (*Journal Officiel*, 30 April) has instituted the Diploma [illegible] to be granted to persons who prove that they possess a s[illegible]

ledge for the complete production of pure and selected silkworm seeds. In order to obtain a diploma the candidate must take a written examination in the following subjects:

Anatomy, physiology, metamorphoses, reproductive functions of the silkworm; structure of the eggs, study of external influences, preservation of the eggs, incubation, hatching; pathology: disease symptoms, causes, remedies, special study of pebrine, flacherie, wasting, etc., Pasteur treatment, silkworm rearing, genetics, removal of the cocoon, methods of breeding, selection from the point of view of abundant production of silk, appearance of the moth, microscopy of the moths and of the eggs, packing of the silkworm seed. Laboratory for the preparation of the seeds, Administrative and Legislative measures in France and abroad.

There is also an oral examination, a practical microscope test, and a practical test on the preparation of the seed. (*Bulletin de l'Office de Renseignements agricoles*, No. 9, 1925).

918. **France: Schools of Agriculture.** — In the *Comptes Rendus* of the general meeting in 1925 of the *Société des Agriculteurs de France* information is inserted on the activities and present educational facilities of various educational institutions in respect of instruction in agriculture. These notices are part of as many short reports read to the Social Section of agricultural instruction and referring to the following schools: Angers, Flers de l'Orne, the secondary school of agriculture of the Union of Anjou, of Mairoy, Avron and Meslay, of la Félicité in Aix-en-Provence, Purpan, the Thénard school at Sens, the Morbihan schools, and those of Vauseblets (Guernsey), Lunéville and the Institution MICHEL PERRET at Limonest (Rhône).

Reports were also made on the agricultural instruction in the Landes, in Finistère and in the Pas de Calais and on the household management instruction. (*Bulletin de la Société des Agriculteurs de France*, Vol. LVI, *Session générale de* 1925).

919. **France: Agricultural Subjects for Prize Competition** set by the *Société des Agriculteurs de France*. — *Agriculture*: Chemical processes for weed killing. Comparative experiments and results: quantity of chemicals employed, proper time for the process, cost, etc. — *Horticulture*: The best forms or best varieties in a given district for intensive cultivation on a commercial scale for profit. — *Viticulture*: Liqueur wines considered in relation to the vineyard: their preparation and their effect on grading of wines. — *Animal husbandry*: Persistent diarrhoea of cattle (*enteritis paratuberculosa*) regarded as a special disease of certain regions, its frequency, severity, economic importance, safeguards or prophylaxis treatment.

In addition, the Section "Live Stock Economy" of the Society has announced the SCHNEIDER prize competition to be awarded to the best account of the Breeders' Unions for the improvement of stock, especially in the countries with breeds not yet established and in regions devastated by the war. This last competition closes on 31 December 1926, while for the four previously mentioned the date on which entries close is fixed for 31 December 1925. (*Bulletin de la Société des agriculteurs de France*, Year 57, No. 6, Paris, 1925).

920. **France: Agricultural Educational Journey in Alsace.** — The Institut National Agronomique of France has organized this year, with

the help of the Société commerciale des Potasses, an expedition into Alsace for 92 students of the second year. The objectives of the journey were the inspection of the sylvinite beds and of the works for the treatment of the raw mineral, a study of the vineyards in the neighbourhood of Colmar and the examination of the Alsatian forests on the plain and on the mountains. (*Journal d'Agriculture pratique*, Year 89, No. 27, Paris, 1925).

921. **Tunis: Agricultural Education.** — This is mainly given at the Ecole Coloniale d'Agriculture at Tunis and at the Smindja Farm School. The colonial school is attended by students who are already well advanced in their work, while the Smindja school receives boys from 14 to 18 years old, just leaving the primary school and anxious to learn modern methods of cultivation. The farm training of the boys whose general education is not up to the standard for admission to the Smindja school is carried on in the regional experimental gardens (Sfax, El Asib, Tabarka) and by means of courses for drivers of farm machinery, held at the Colonial School at Tunis.

The diffusion of agricultural information and of improved methods of cultivation is ensured by publications, practical demonstrations, seasonal courses. A monthly publication in Arabic, *La Mejellah*, of which 5000 copies are printed, and a farm calendar of the fellah, with 1500 copies are distributed free.

In 1924, 76 demonstration fields have been organized for native cultivators: 48 for illustrating the preparation of the soil and the use of superphosphates for the cultivation of cereals, and 28 relating to the use of chemical fertilisers for olives. In the districts of Kef, Thala, Maktar, Teboursouk, Medjez-el-Bab, Souk-el-Arba, Mateur, Soussa, Kairouan, Gafsa, Tozeur and in the military territories there have been held 35 demonstrations on pruning and grafting of olives, which were attended by 1060 persons. In Tunis and at Soliman two olive-pruning competitions took place and also courses and competitions in olive grafting.

As a means of encouragement, plants, plant, seeds or silkworm seed fertili-
sers, money prizes, medals, and diplomas for irrigation works or horse breed-
ing, etc., are being distributed to the native farmers. (Fixation des indigènes
au sol. *Bulletin Mensuel de l'Office du Protectorat Français, Tunisie*. Year 18,
No. 170).

922. **French West Africa: Ivory Coast. La Mé Experimental Station.** — In the first half of 1924, besides a certain amount of clearing work, plantations have been made of oil palms and intercalary crops, cocoa and coffee. For germination, boxes have been used in which the coconuts were placed on a hotbed in layers under leaves of "Celtis". The transplanting was done both on to the open ground and among bushes. Some tests were carried out on a native method consisting in warming the fruit to hasten germination. The soil recently broken up was protected against the action of the sun's rays and the invasion of weeds by sowing with runner beans and Angola peas.

Experiments have been made on the different methods of employing a wooden press for making wine and cider, and a yield much superior to that obtained by native methods has been the result. The Laboratory has been meanwhile completely equipped. (*Bulletin mensuel de l'Agence économique de l'Afrique occidentale française*. Year 6, No. 50, Paris 1925).

923. **Dahomey: The Pobé Experimental Station.** — The special object of this station is investigation of oil palms, their cultivation and industrial utilization. The results of laboratory researches have been used in the selection of the palm nuts and for ascertaining the best conditions for the extraction of the oil. (*Bulletin mensuel de l'Agence économique de l'Afrique occidentale française*, Year 6, No. 50, Paris, 1925).

924. **Great Britain: A Section of Timber Technology at the Imperial Forestry Institute, Oxford.** — Professor C. C. FORSAITH, of New York, State College of Forestry, Syracusa University, has accepted an offer of the British Government, made through the Imperial Forestry Institute of the University of Oxford to organize a section of timber technology in that University.

925. **Scottish Experimental Stock Farm.** — In connection with the Rowett Institute, Aberdeen, an experimental stock farm is to be established, as a memorial to the famous breeder of Shorthorn cattle, WILLIAM DUTHIE of Collynie, whose nephew, M. Duthie WEBSTER, has given £ 10.000 to the Institute for this purpose. (*The Times*, London, 11 May 1925).

926. **Great Britain: Training of Agricultural Organizers and Lecturers.** — In conjunction with the Development Commission, the Departments of Agriculture for England and Wales and Scotland have instituted a new class of scholarships with the object of training those who desire eventually to take up posts as agricultural organizers under county councils or as lecturers, whether at agricultural departments of universities, agricultural colleges, or farm institutes. The scholarships are of two years' duration, the first year being spent on investigational work in Great Britain and the second year abroad. The scholarship allowance in the first year will normally be £200: the allowance in the second year will include provision for extra cost of travel and other expenses abroad. (*Science*, Vol. LXI, No. 1575).

927. **Great Britain: Settlers' College.** — The Australian Farms Training College will be opened in Norfolk during September, for the training in practical farming of university and public school men, on the completion of which they will be sent out to Queensland under specially advantageous conditions, by arrangement with the Queensland Government. Each man must possess a capital of £500, and the Queensland Government will make a loan not exceeding £750 to every settler, and will reserve a large tract of land for settlement.

The course at the College will include: general farm instruction, principles of cultivation of crops likely to be grown in Queensland, dairy work, stock raising, fencing and carpentry, and the erection of a portable house in which students will live for a time and do their own cooking. Pig breeding will form the main subject of the course. The Principal of the new college will be Mr H. V. POTTS, formerly Principal of Hawkesbury Agricultural College, New South Wales. (*The Times*, London, June 15, 1925).

928. **Great Britain: Scientific Research Workers.** — The British Science Guild has held an enquiry into the question of the supply of trained scientific research workers, and summarises several of the questions that arose, as follows:—

(1) The annual supply of research workers before the war was very limited and inadequate to the needs of the Nation.

(2) In response to urgent appeals, and with assistance by the Government, the annual number of science students at the Universities of Great Britain has been doubled, while the number of research students has been quadrupled.

(3) The present facilities for training scientific research workers in Great Britain are, however, still less than those of Germany and America before the war.

(4) There is still considerable unemployment among research workers and freshly trained men are finding difficulty in obtaining suitable posts.

(5) Apart from the work of the Department of Scientific and Industrial Research, little fundamental research is undertaken by commercial firms, and the work of the Department itself is limited by its comparatively meagre endowments. (*Chemical News*, Vol. 130, No. 3395, 1925).

929. **British Guiana: The Kartabo Laboratory of Tropical Biology.** — The Tropical Research Station of the New York Zoological Society located at Kartabo, British Guiana, has come under the University of Pittsburgh for several years. During the summer of 1924 eight students worked at this jungle laboratory, under the direction of Dr. ALFRED EMERSON, of the department of zoology. This experiment proved so successful that further courses are planned. According to a communication made by Prof EMERSON to the periodical, *Science*, during the summer of 1925, a group of fifteen students will study at the laboratory under the direction of Dr S. H. WILLIAMS professor of zoology at the University of Pittsburgh, who will also give a course in ecology. The expenses for each student will be approximately 700 dollars, including travelling and living expenses and incidentals from New York and return. Stops will be made at the West Indian islands of Grenada and Trinidad.

Visits may be made to the Station at any time of the year by scientists. For information application should be made to Professor H. D. FISH, Department of Zoology, University of Pittsburgh, Pennsylvania (*Science*, Vol. LXI, No. 1576, 1925).

930. **India: The Technological Research Laboratory of the Indian Central Cotton Committee** was formally opened at Bombay by H. E. the Viceroy of India on December 3, 1924. When complete, there will be Spinning and Research Laboratories; the former has been completed and is equipped with a spinning plant and instruments for testing cotton yarn. The Research Laboratory will carry out chemical, physical and microscopical examinations of cottons sent for trial. By collating the results obtained in the two laboratories from a sample of raw cotton, it is hoped that it will be possible to make a fairly accurate statement as to the spinning qualities of a cotton and in this way assist plant breeders. (*The Agric. Jour. of India*, Vol. XX, Part II, Calcutta, 1925).

931. **Ceylon: New Chemical Laboratory at Peradeniya.** — The new Chemical Laboratory of the Department of Agriculture was opened by H. E. the Governor on March 12, 1925. The new laboratory has been established in order to meet the urgent need for further research in agricultural chemistry

Accommodation will be provided for post-graduate students from the University of Colombo. (*Tropical Agriculturist*, LXIV, No. 4, Peradeniya, 1924).

932. **The Imperial College of Tropical Agriculture, Trinidad.** — An important meeting with reference to the above College took place at the Mansion House, London, January 20, when Lord Milner's appeal for £100,000 was presented by Lord Burnham and supported by Sir Arthur Shipley of Cambridge. The sum is required to complete and equip the new buildings and laboratories, and place the institution on a sound basis for research. The College is of international interest, as it is the only institution of the kind in the world; its great aim is to increase knowledge and to apply such knowledge to the development of agriculture and to the increase of crop production. (*Tropical Life*, Vol. XXI, No. 2, London, 1925).

933. **Palestine: The Hebrew University of Jerusalem.** — The formal opening of the new University of Jerusalem by Lord BALFOUR took place on 1 April last. At that date the laboratories for chemistry (including general chemistry, analytical chemistry, biological chemistry, and chemistry of colloids) and bacteriology were already organised, and those for physiology, physics and mathematics were in process of organisation. (*Chemistry and Industry*, Year 44, No. 14, London, 1925).

934. **Hungary: Higher Forestry Instruction.** — In consequence of the occupation by Czecho-Slovakia of Upper Hungary, the teaching staff of the old-established higher school of mining and forestry at Cheminitz has been moved to Sopron (Cedenburg). The foundation of this school dates from 1770, and it has given a number of distinguished names to Hungarian sylviculture, including HEINRICH DAVID WILCKENS (1832), RUDOLF FEISTMANTEL (1871), FRIEDRICH SCHWARTZ (1866), KARL WAGNER, JACOB LAZÁR, JULIUS SOLTZ and LUDWIG FEKET. The new school which is established at Sopron took the name of the Royal Hungarian Higher School for Mining and Forestry Engineers (*Kön. Ung. Hochschule fur Bergingenieure und Forstingenieure*), and retained the former division into four faculties: forestry, mining, the working of steel, metallurgy, all of which grant the diploma of engineer.

The system was antiquated and was not compatible with the scheme of conferring the diploma of forestry engineer alone after four years of study in the higher school and two years practice. Hence it has been abandoned and replaced by the so-called *rigorosum* system, which includes two examinations, one at the end of the fourth and the other at the end of the eighth half year. The subjects to be offered in the first are: mathematics, botany, geodesy, forest classification; in the second: sylviculture, forest production, forest organisation.

The faculty of sylviculture includes the following chairs, with the necessary buildings and collections of objects in addition: botany, including general and special botany, and phylogenetics; chemistry and forest soil science, including organic and inorganic chemistry, forest classification; forest zoology and protection of forests; geodesy and systematisation of mountain water courses, forest railways, roads and water supply, forest organisation, including measuring of timber and forest estimates; utilisation of forest products, including timber dealing; sylviculture, game and fishing regulations; forestry policy, including national economy and the administration of forests; forest techno-

logy, including the construction of the machines and the mechanical technology of timber; physiology and pathology of forest species. Instruction will also be given in forest law and legislation relating to forests, while for the other subjects: mathematics, descriptive geometry, geology, [illegible] civil law, commercial law, administrative law, etc., instruction is given by a staff common to the other faculties.

Practical expeditions are made into the rich forests of Sopron which extend over 9000 *Kat-Joch* (cadastral yokes: one *Kat-Joch* equals about half a hectare, i. e. about an acre), on the slopes of the Austrian Alps. Of this forest area, 3200 *Kat-Joch*, in Agendorf near the Austrian border, are administered by a Royal Hungarian Office, as a demonstration forest park, attached to the Higher School of Sopron. (*Centr. f. D. Forstwesen*, Year [illegible], Parts [illegible], Vienna and Leipzig, 1925).

935. **Italy: The Bari Agricultural Experiment Station.** — This station was inaugurated on 12 April 1923 and is under the direction of Prof. ENRICO PANTANELLI. Among its principal functions is the study of the soils and the climate of Southern Italy, with a view to the selection of the varieties of grain and forage plants, taking as criterion resistance to drought. As will be seen from the address on the occasion of the inauguration of this new institution, by His Excellency, DE CAPITANI D'ARZAGO, Minister of Agriculture, the programme is designed with a view to the increase of the production of grain and forage plants and has already been drawn up by CELSO ULPIANI and the watchword "American dry-farming" put in the forefront of the work of the Station. Among its other responsibilities will be that of encouraging arboriculture, and of investigating the possibility of drawing on, for agricultural purposes, the waters that lie unused in the subsoil of great stretches of Southern Italy.

From a report on the activity of the Station in 1922-23, the valuable work already accomplished by the Station in the two years 1922-23 is evident. Investigations and work on soils were made of the soils of Apulia, investigations of underground water, experiments in irrigation, fertilising and cultivation; meteorological observations taken; cultivation and selection of spring cereals, cultivation of summer cereal crops, pulse crops, forage plants, industrial aromatic and medicinal plants, and vegetables for profit, enquiries on the cultivation of olives, the almond, ornamental plants and exotic plants for profit.

The report quoted is full of information of all kinds, and is illustrated by a number of plates, presenting a thoroughly practical survey of the field of experiment that may be worked on behalf of the agriculture of Southern Italy. (*Stazione agraria sperimentale di Bari*. Report on the activity of the Station in the two years 1922-23: pp. VII + 143 small octavo, [illegible] Bari, 1924).

936. **Italy: Development of the Agricultural Cinematograph.** — This is now in course of full development in Italy and is making itself felt as a method of the first rank for the diffusion of progressive ideas in the country districts. Although not at the outset supported financially and otherwise as generously as it might, and should have been, by the competent State authorities, the agricultural cinematograph, owing to the efforts and the enthusiasm of various agencies, societies, private individuals and [illegible]

bodies, has succeeded in proving its importance, so that it is now regarded as an indispensable adjunct to instruction.

Propaganda by means of the cinematograph is organized by the " National Institute Cerere ". Among the most important films are to be noted those on scientific fertilising, on cultivation of cereals, viticulture and fruit growing, industrial plants, control of plant diseases. Beginning with 160 films in 1920, the number was raised to 1200 in 1922 and to 2000 in 1924, while in the current year provision is being made for a larger number.

Films on vegetable growing, on olive and citrus fruit cultivation, and stock rearing and preservation of forage are being prepared.

937. **Paraguay : School of Agriculture at Asuncion.** — Authority has recently been given for the establishment of an agricultural school in the Botanical Garden of Asunción under the direction of the botanical staff. The amount of 600,000 pesos national currency is appropriated for the equipment of the school. The sales of the school's products will help to defray expenses. (*Bulletin of the Pan-American Union*, January 1925).

938. **Czecho-Slovakia : Jubilee of the School of Agriculture of Tetschen-Liebwerd.** — On 6 May last a celebration took place at Liebwerd on the occasion of the 75th anniversary of the foundation of the Agricultural Section (*Landwirtschaftliche Abteilung*) of the German Higher Technical School (*Deutsche Hochschule*) at Prague. After the official speeches on the occasion, the Dean of the Section, Prof. WIRTH, delivered an address which was highly applauded, in the course of which he gave an account of the development of the natural sciences, and of agriculture at the school and also of the future prospects of the Liebwerd School. (*Landwirtschaftliche Fachpresse fur die Tschechoslovakei*, Year 3, No. 17, Tetschen).

939. **Czecho-Slovakia : Agricultural Museums.** — On 4 March 1924, the Minister of Agriculture, Dr. RODZA, set aside 15 million crowns for an agricultural museum at Prague and a similar institution at Bratislavia. In addition, the Ministry of Agriculture has now bought the land on which to place the building for the Prague Museum, while for that at Bratislavia the ground has been purchased by a Committee appointed for the purpose. Special Museums of agricultural interest already exist in Czecho-Slovakia, for example there is one at Brunn, attached to the Higher School of Agriculture, and one at Frydek (Silesia). (*Publication du Ministère de l'Agriculture de la République Tchécoslovaque*, Prague, 1 May 1925).

940. **Czecho-Slovakia : Course of Instruction for Milk Testers, at Znaim.** — The German Section of the Moravian Council of Instruction in the provincial school of agriculture and oenology at Znaim organized a practical technical course, from 15 April to 16 May 1925, for assistant testers of milk. The number of those taking part in the course was limited to 12 and only sons of farmers were admitted. Admission was limited to students over 18 years of age, of good physical constitution, who had already satisfactorily passed through a lower agricultural school. Each of them received 500 crowns to cover expenses, and were on the other hand under an engagement to take positions as assistant testers on finishing the course. If this undertaking was not observed, the subsidy received had to be returned, and in the case of students under age, the father or the guardian were legally liable for the repay-

ment. Six students could be lodged and boarded on the premises of the school for the sum of 310 crowns each. (*Landwirtschaftliche Fachpresse für die Tschechoslowakei*) Year 3., No. 10. Teschen, 1925).

Agricultural and Scientific Associations and Institutions.

941. **The Singapore Office of Epidemiology.** — A Conference was held at Singapore from 4 to 15 February 1925 on the occasion of the inauguration of the Far-East Epidemiological Information Bureau. Representatives attended of the health offices of Ceylon, China, British Borneo, the Straits Settlements, the Federated Malay States, British India, French Indo-China, Dutch India, Hong-Kong, Japan and the Philippine Islands. In addition Dr. NORMAN WHITE, member of the Commission on Epidemics attended as delegate of the League of Nations.

The subject of the Conference was the establishment of the rules for the working of the Singapore Office of Epidemiology. The maintenance of the Office is for the time being ensured by the Rockefeller Foundation which has placed at the disposal of the Health Organization of the League of Nations 125,000 dollars to be assigned over a period of five years. The Rockefeller Foundation attaches a condition that the annual expenditure is not to exceed 50,000 dollars. It is hoped that the Governments concerned will take the necessary measures for ensuring the funds for maintaining the Singapore Office, if after the five years its work has proved of value. Dr. GILBERT BROOKE, of the Straits Settlement Medical Service, has been placed in charge of the Office. (*Résumé mensuel des travaux de la Société des Nations*, Vol. V No. 4 [illegible]

942. **The Belgian Peasants' Union** (*Boerenbond*). — On 1 June last the General Assembly of the Belgian *Boerenbond* was held at Louvain, attended by 2000 delegates of the respective agricultural syndicates. From the report for 1924 made by the General Secretary, Canon LUYTGAERENS, it appears that at the end of the year in question the number of the guild had risen to [illegible] including in all 98,706 members, representing as many families.

The work of the *Boerenbond* is carried on by the Secretariate in collaboration with the subordinate services: documentation, inspection, League of Farmwomen's Clubs, General Federation of Horticulturists. The intention of the Union is to promote both the general education, and the technical knowledge of the members, as well as their social sense and feeling for co-operation. Every year the *Boerenbond* organizes a series of "days of study" attended by about 800 representatives as a rule: it publishes two weekly journals and monthly reviews. In 1924 it published also eight treatises and technical manuals and arranged for the holding of 3440 lectures to agricultural syndicates.

The *Boerenbond* carried on systematic action with a view to promoting vocational agricultural education and for that purpose has established in some centres, courses of training for women teachers to give instruction in the elementary stages of rural household management, which courses were followed by 187 students. It took part also in the setting up of [illegible] district agricultural schools, intended for pupils who have already satisfactorily passed through the courses of elementary stages, or sections. On the other hand 20[illegible] of these elementary sections, established by the initiative or with the co-operation

of the guilds, have entered successfully on their third year of existence. In 1924 the League undertook a campaign for the development of rural libraries and for the foundation of a technical agricultural library in connection with every syndicate.

The League of Farmwomen's Clubs, which included at the end of 1924 336 affiliated clubs with a total of 56224 members, has organized 117 courses, each of 3 to 4 days, on various subjects of interest, in particular household science, in addition to a series of 4 "days of study" at Louvain, attended by 241 local organising members, and 8 provincial "days" for rural housewives, attended on each occasion by thousands of peasant women; 1884 lectures were also given. The General Federation of Horticulturists arranged 178 lectures, held 17 local "days of study" for potato growing, undertook an educational journey in Holland and Poland, and organised several regional horticultural exhibitions. Competitions in cultivation were organised on a larger scale, and in the province of Antwerp alone 213 plots for rye and 274 for potatoes were planned for this purpose. The technical services: buildings, drainage, electricity, displayed great activity, and 1485 analyses were made by the laboratory.

At the end of 1924, there were 112 local agricultural syndicates affiliated to the "General Federation of the Stock-breeding Syndicates". The department for small live stock breeding was in touch with 24 poultry keeping unions. The *Boerenbond* also continued to carry on valuable work in connection with tariffs taxation, mutual insurance, the housing crisis, war losses and also more directly by the joint purchase and sale of eggs and butter, and the *Comptoir d'achat et de vente*, among its other activities, purchased for its members in 1924 196,528 tons of fertiliser, feeding stuffs and other agricultural requisites. The value of these goods, together with that of the supplies of farm machinery and dairy equipment amounted to more than 108 million francs.

There should also be mentioned the work, by no means unimportant, done in connection with agricultural credit, insurances and land improvement, subjects outside the scope of this Review (Report, communicated to the International Institute of Agriculture by the *Belgische Boerenbond*, 24 Minderbroedersraat, Louvain, Belgium).

943. **Brazil: The Government Seeds Service and the Cotton Service.** Seeds. — In 1923 there were incorporated with the Department of Agricultural Inspection and Development (*Serviço de Inspecção e Fomento agricolas*) the seed farms of the former Sowings Service (*Serviço de Sementeiras*), and, by the Decree No. 16663 of 5 November 1924, also the Deodoro Pomological Station (*Estação de Pomicoltura*) and its independent sections. Of the seed farms now in existence Rezende (in the Rio Janeiro district), Lorena, São Simão (State of Sao Paulo), Itajahy (State of Santa Catharina) and Rio Branco (State of Minas), the three first are in full working order, particularly the farm of São Simão, which is yielding excellent results. In that of Lorena, which is passing through its initial stage, an area of 75 hectares is being prepared which will very shortly offer the best conditions for rice growing by irrigation. On the Rezende farm 45 hectares were brought under cultivation and good progress has been made with the laying out of nursery plots. The Itajahy farm needs a larger area to attain real success, and the Rio Branco farm is in process of organisation.

In 1924 distributions were made by the Ministry of [illegible] seeds of the following species: lucerne, 6,881,000 kg.; [illegible] "capim jaragua", 36,749,000; "capim gordura roxo", 52,[illegible]; beans, 983,000; millet, 47,157,000; wheat, 6[illegible] sweet potatoes, 1,307,145; "mucuna", 34,739,000; miscellaneous seeds, [illegible] kg. [illegible] grafts were also distributed. The plants distributed from the [illegible] Station amounted to 31,813, of which 7771 were grafted.

Cotton Service (Serviço do Algodão). This service was organised by the Decree No. 16 122 of 12 August 1923 and continues to produce excellent results. The total production of cotton in 1924-25 is reckoned at 131,118 metric tons and taking into account that the consumption of raw [illegible] by the Brazilian spinning and textile factories, from 1920 to 1924, has increased by about 10,000 metric tons, it is clear that the cultivation of cotton in Brazil is steadily being extended. Agreements have been concluded with the States of Parà, Bahia, Minas Geraes di Parahyba, Rio de Janeiro, Sergipe Maranhao, Pernambuco, Rio Grande do Norte, Ceara and Alagoas, for the carrying on of the cotton-growing services and in the last six States the work is done by the respective governments under the technical direction of the Ministry of Agriculture. In the States of Parà, Bahia, Minas Geraes, Parahyba and Rio de Janeiro, the services in question are actively carried on and there are six "fazendas" for seed, with plantations in full working order. Progress is being made as regards Experiment Stations and seed "fazendas" in Sergipe, Ceara and Pernambuco, and in Alagoas although the agreement is of much more recent date, considerable interest in cotton cultivation is already observable.

Mention may also be made of the Union of Experiment Stations of [illegible] cicaba and Serido and of the Fazenda de Sementes of Coreatà the object of which is the systematic selection of the improved varieties.

The Government Cotton Service has distributed 175,300 kg. of seed of the varieties best adapted for the different parts of the country. In accordance with the resolutions passed by the International Cotton Conference of 1922, the Government proposes to establish cotton exchanges in Rio de Janeiro and in other Brazilian markets.

Cleaning and Disinfection of Seed. — In 1924 there was a noticeable falling off in the activity of the service for cleaning and disinfection of seed, as compared with 1923, when 80,760 sacks of seed were cleaned, etc. In the following year 20,761 empty sacks were [illegible] which had previously been used for coffee. In conjunction with the Superintendence of Cotton Department a disinfecting machine was installed to effect disinfection of cotton seed and bales, by means of [illegible] gas. (*Mensagem apresentada ao Congresso Nacional na abertura da segunda sessao da decima segunda legislatura pelo [illegible] da Republica* ARTHUR DA SILVA BERNARDES: 1925, *Diario Official*, May [illegible]).

941. **Brazil: A Permanent Government Agricultural Information Service.** — From a communication made by M. [illegible] Delegate of the Brazilian Government at the International Institute of Agriculture, the following information is taken as to a new Service which the Brazilian Government has established with the object of [illegible]

month on the agricultural situation in every commune of Brazil as regards the principal crops.

The Service, which is defined as an agricultural statistical service endeavours to collect each month, for a series of crops, the facts relating to sown areas, crop conditions (100 = very good; 80 = good; 60 = average; 40 = poor; 20 = very poor; 0 = means destruction of the crop); prospects of yield (normal, increase, reduction), preliminary harvest forecast and actual yield. Reports are made on the following crops: pineapples, lucerne, cotton, rice, oats, bananas, potatoes, rye, barley, beans, maté, maize, wheat, tobacco, oranges. Data are also received as regards the forecasts, the preliminary estimates and the actual yield of sugar (first, second and third class), molasses, brandy, alcohol, flour, cassava and wine.

The information is collected in every Commune of the Federation of Brazil by means of monthly enquiry forms, both by farmers and individual volunteers, and by the officials of the service of Inspeçao e Fomento Agricola e Industria Pastoril, and of other public bodies set up for the purpose. As a basis of comparison, the correspondents receive the data of the previous year, relating to their Commune. The enquiry forms are returned, not later than the tenth of the month succeeding the month to which they refer, to the Federal Agricultural Inspectorate to which the Commune belongs or directly to the Head Office of the Serviço de Inspeçao e Fomento Agricolas at Rio Janeiro. (*L'organisation récente de la statistique agricole au Brésil*. Communication made by M. DEOCLECIO DE CAMPOS, delegate of Brazil to the International Institute of Agriculture, 1925).

945. **France: "Colonie-Sciences" Association.** — Under this name there has been founded in Paris (12, Avenue du Maine), under the presidency of General Messimey, an association the object of which is to bring together, for work in common, the colonial agricultural experts, the colonial laboratories, institutes and similar organisations. The intention is to specify in detail the scientific methods of cultivation in the colonies, to set up a service of documentation and of centralisation of information on the various branches of colonial agriculture, to make enquiries into and to carry into effect the schemes best calculated to increase the number of agricultural experts and colonial technicians, and to promote the establishment of new Experiment Stations in the colonies and to make fuller use of those already existing. The Proceedings and the Reports, as also the scientific publications of the "Colonie-Sciences", will be published in the *Revue de Botanique appliquée et d'Agriculture coloniale*. (*La Nature*, No. 2672, Paris, 1925).

946. **Great Britain: Apple Packing Stations.** — In an article in the *Journal of Pomology and Horticultural Science*, H. V. TAYLOR states that some progress has been made in the use of grading and packing systems for home grown apples in England, and refers also by way of explanation to what is done in this respect in Canada and the United States. The British Fruit Packing Co. Ltd. has lately established near Yalding Railway Station, Kent, an apple packing station, equipped with the most modern machinery. This station is managed by Mr. GREGSON, who has had experience of the working of an apple packing station belonging to the Associated Growers of British Columbia. The Kent Station is favourably situated in the midst of a very large fruit area, and can

handle daily a large quantity of fruit. Besides grading and packing the apples, the Company undertakes the transport of the fruit by road to the London markets.

A second station on the same lines has been established at Cottenham near Cambridge, as a result of the action of the "West Cambridge Fruit Growers Association" and of State assistance. Both the Stations will adhere to the same standards for grade. (H. V. TAYLOR, M.B.E., A.R.C.S., B. Sc. Apple Packing Stations, Progress in England. *The Journal of Pomology and Horticultural Science*, Vol. IV, No. 7. London, 1925).

947. **Canada: The Dominion Water Power and Reclamation Service.** — This Department of the Canadian Ministry of the Interior has published a report on its activity including production of hydraulic power, irrigation, drainage, etc., in the financial year ending 31 March 1924. In the previous years, the two Services, that of the water power and the reclamation department, were distinct and hence their respective reports were published separately. This year a single report has been issued on both departments as they have been combined. (*Canadian Water Power and Reclamation Report*, [illegible] pp. 25 plates, Ottawa, 1925).

948. **Italy: The "Parco Nazionale d'Abruzzo".** — By a decree of July 12, 1923, the Parco Nazionale d'Abruzzo was given independent status. This action had already been contemplated in a preceding decree of January of the same year. In this way one of the most picturesque areas of the world was placed under the protection of the law. The Hon. ERMINIO SIPARI, President of the "Consorzio per la Condotta Forestale Marsicana" and of the "Commissione amministratrice dell'Ente autonomo del Parco", has arranged for the publication of a manual containing the legal enactments and general information relating to the district. As early as 1923, the Hon. SIPARI informs us in his preface to the little book, the need for the prompt publication of a first edition was felt, in order to bring to the attention of those Communes whose territory comes partly within the Park the relevant legislative enactments. The manual is fairly exhaustive, though it must not be considered as a final edition, since it will be added to by degrees as the regulations and the general provisions in regard to the Park are improved.

SIPARI, with the consent of the respective authors, has added to this new edition special articles which have been published already in another form. Besides an article by SIPARI himself, which summarized briefly the proceedings which led to the issuing of the decree concerning the Park, the manual contains a description of the Park from Gioia to Forcadaccio, already published in *Saggi di Itinerari turistici per l'Abruzzo e Molise* by L. BOLOGNA, the description of a trip from *Villavallelonga a Bisegna attraverso il Parco* by A. ROSSI, and an article by E. MARCHETTI on *La Valle dell'Alto Sangro*. Finally, in order to render the manual of still greater practical value, two chapters were included, one on information concerning the destruction of noxious animals [illegible] Park [illegible] information on vipers, edited by Dr. CARLO PAOLUCCI [illegible] (*Manuale del Parco Nazionale d'Abruzzo*, 2nd edition [illegible] grafica. Roma, 1925).

949. **Czecho-Slovakia: Horse-Breeding in Czecho-Slovakia.** — According to the *Narod Listy* the State civil and military [illegible]

tions in Czecho-Slovakia have been given up for reasons of economy, following on proposals made by the Breeders' Unions interested. The Government stations will be replaced by others belonging to district Consortiums for horse-breeding. It has been shown that a horse costs 35,000 crowns to rear up to the age of 4 years in the State stations, whilst the market price of a horse of the same age is barely 7,000 crowns. (*Landwirtschaftliche Fachpresse*, Year 3, No. 17, Tetschen, 1925).

Congresses and Conferences.

930. **France: International Dairy Conference. Paris, May 1925.** — The Permanent Bureau of the "Fédération Internationale de Laiterie" met on May 9, 1925 at Brussels, under the presidency of the deputy the Hon J. MAENCHANT. Delegates from the National Committees of France, England, Holland, Denmark, Switzerland and Belgium were also present. The delegates of Sweden, Norway, Ireland and the Grand Duchy of Luxemburg regretted their inability to attend.

The Permanent Commission fixed the order of the future Congresses to be held in Europe as follows: in France, 1926; in England, 1928; in Belgium, 1930; in Denmark, 1932; and in Italy, 1934.

The Congress of 1926 will take place in Paris in the first fortnight of May. The question of milk will be discussed very fully, that of the designation of cheeses in international trade, and the question of the formation of an "International Dairy Bureau" at Brussels.

931. **Canada: World's Poultry Congress 1927.** — This Congress will be held in Canada in 1927 on the invitation of the Dominion Government. An influential Committee has been formed representing all the provinces of Canada, with members also from the United States. The honorary Chairman is the Dominion Minister of Agriculture, and the Acting Chairman is Dr. GRISDALE, Deputy Minister of Agriculture. At a meeting of this Committee held in Toronto on 11 September, it was decided that the Congress and Exhibition shall be held at Ottawa, commencing 27 July 1927. The fine buildings of the Canadian Exibition at Ottawa have been placed at the disposal of the Committee. Mr. EDWARD BROWN F. L. S., President of the *International Association of Poultry Instructors and Investigators*, has accepted the position as President of the Congress and Exhibition. Official invitations will in due course be sent to all Governments to participate in the Congress and Exhibition, and plans are being formulated for securing the co-operation of those engaged in investigations and research as well as producers and distributors.

932. **Belgium: Second International Conference for the unification of the formula for heroic remedies. Brussels, September 21, 1925.** — Following on the First Conference held in 1902 also at Brussels.

933. **I. International Congress of the Technical Press. Paris, September, 1925.** — Under the auspices of the Syndicate of the technico-industrial, commercial and agricultural Press of France. The aim of the Congress was to examine all the relevant questions, both from the technical and financial points of view, and to study the best means of increasing the circulation of the technical press throughout the world.

954. **Rumania : International Congress of Pure and Applied Chemistry. Bucharest, last week of June, 1925.**

955. **Poland : First International Conference of Sugarbeet Growers. Warsaw, 20 June, 1925.** — This conference was called by the General Polish Confereration of Sugarbeet Growers, with the object of presenting to the 12th International Congress of Agriculture a programme for the protection of the growing of sugarbeet in Europe against the competition of cane sugar.

956. **France : International Silk Congress. Paris, 12-13 June, 1925.** — Promoted by the Silk Federation. Points discussed: unification of the customs tariff for the silk industry ; uniform designation of artificial silk ; improvement of natural and artificial silk ; procedure for the examination and control ot the quality, weight and condition of the various silk textures.

957. **Proceedings of the Second World Poultry Congress.** — This has been translated into French and contains the 87 reports presented to this Congress, held at Barcelona, 10-18 March 1924. It forms a volume of octavo 430 pp., illustrated by numerous plates.

958. **Germany : General Assembly of the German Chemical Societies of Food Industries.** — (Vereine Deutscher Nahrungsmittelchemiker) Munster Westfalia, March 21-22, 1925).

959. **Belgium : Maritime and Colonial Congress. Ostend, 24-28 August, 1925.**

960. **Brazil : Oil Congress. San Paolo, Brazil.** (date not yet fixed).

961. **Canada : Fox Congress, Montreal, 26-28 June, 1925.** — Promoted by the American Fox Institute. For information apply to Mr H. A. Adams (Secretary), Investment Building, Washington, D. C., United States.

962. **French National Week for the Export of Agricultural Products.** — The date of this "*Semaine nationale de l'exportation des produits agricoles*" is still not fixed at the time of publication of the present number. It will comprise four sections: I. Foreign markets; II. Exportable products; III. North Africa ; IV. Ways and means for the assistance of agricultural export. The subject of the agenda of Sections II and IV have been published.

Section II : (1) Breeding, draught animals, butchers' beasts, slaughtered beasts, meat and by-products ; — (2) Dairy products ; — (3) Poultry etc. ; — (4) Seeds ; — (5) Cut flowers ; — (6) Tree and flower nurseries ; — (7) Fruit (fresh, dried or desiccated) : horticulture by irrigation, early vegetables, dried vegetables ; — (8) Cider industry ; — (9) Table grapes ; — (10) Effects of export on French vineyards ; — (11) Good quality wine and liqueurs ; — (12) Brandy ; — (13) Fodder cereals and straw ; — (14) Flour and bran ; — (15) Maccaroni, etc ; — (16) Beetroot, sugar, syrups, sweets, preserves ; — (17) Potatoes ; — (18) Agriculture, honey, wax ; — (19) Hops ; — (20) Textile plants ; — (21) Silk growing ; — (22) Essential oils ; — (23) Preserving industry ; — (24) Plants used as drugs, medicinal herbs ; — (25) Perfume distillery ; — (26) Timber, forest products, bark, cork.

Section IV : — (1) Agricultural export societies ; — (2) Commercial organisations available for exporters ; — (3) Standardisation of exportable products ; — (4) Measures against unfair competition and the protection of

designations of origin ; — (6) Sanitary and veterinary guarantees with respect to the export of animals ; — (7) Credit in matters of export ; — (8) Function of railways in agricultural exports ; improved utilisation of land transport ; — (9) Export tariffs and combined tariffs ; — (10) Use of ice in transport and warehouses ; — (11) Function of the French flag in the export of agricultural products ; — (12) Commercial agreements ; — (13) General policy on agricultural export.

For particulars : *Secrétariat de la Semaine Nationale de l'Exportation des produits agricoles*, 23, Avenue de Messine, Paris (VIII).

963. **France : Ninth National Congress of Fishery and Sea Industries. Bordeaux and Arcachon, September 1925.** — Seven sections : (1) Scientific enquiries (chairman, JOUBIN, member of the Institute) ; (2) Technique of sea-fishing (chairman, LECOURBE, director of the Pêches maritimes) ; (3) Sea industries (chairman, LAUBOEUF, naval engineer) ; (4) Trade and Sale of products (chairman, LE BAIL, deputy of Finistère) ; (5) Social economy and legislation (chairman, GIRAUD, director at the Undersecretariate of the mercantile marine) ; (6) Colonial fisheries (chairman, GRUVEL, professor at the Musée d'Histoire naturelle) ; (7) Oyster beds (chairman, PRUNIER).

964. **France : Congress of Table Grapes, Agen, August 1925.** — Organised by the Compagnie d'Orléans in collaboration with the agricultural services of the Compagnie P.L.M. et Midi and with the support of the Office départemental agricole du Lot-et-Garonne.

965. **France : Fifth Annual Reunion of the "Comptoir Français de l'Azote". Paris June 1925.** — Lectures : Ing. Agr. TRUFFAUT, The micro-organismes of the nitrogen cycle — Professor BRETIGNIÈRE (École nationale d'Agriculture de Grignon), Nitrogenous fertilisers ; — Prof. SORESI (director of the Milan travelling lectureships on agriculture), Work of the travelling lectureships on agriculture in Italy. — CARROLL (head of the Propaganda Service of the British Sulphate of Ammonia Federation), Result of experiments with ammonium sulphate at Rothamsted and Intensive nitrogenous fertilisation of meadows and pastures. — KONING (manager of the *Comptoir Belge du Sulphate d'Ammoniaque*), Contribution to the study of the application of ammonium sulphate and Lime treatment and nitrification Dr. BUEB (manager of the Berlin *Stickstoffs Syndikat*), Policy for the popularisation of nitrogenous fertilisers.

Photographic projections and cinematographic films will illustrate the different lectures.

According to a communication made to the same assembly, the consumption in France of nitrogenous mineral fertilisers has risen from 71,000 metric tons of nitrogen in 1915 to 96,000 tons in 1924, an increase due chiefly to the consumption of cyanamide and of ammonium sulphate.

966. **France : Seventh French Agricultural Congress. Rouen, 13-15 May, 1925.**

967. **France : Wood Charcoal Congress. Blois, 26 April, 1925.** — Among the numerous solutions proposed for the production of a national carburant, is that of the direct utilisation of wood and wood charcoal. It is estimated that, under regular and normal working the total yield in charcoal of the French forests may amount to 15 million quintals, i. e. double the quantity

required to replace the imported charcoal. In addition much of the waste from wood cutting would at the same time be turned to advantage. The above Congress has been organized, with a view to popularising the employment of this carburant, by the Compagnie d'Orléans in co-operation with the Comité de la Forêt du Loir-et-Cher. (*La vie agricole et rural*, Year 14, Vol. XXVI No. 18, 1925).

968. **Great Britain : The Imperial Entomological Conference, London, 9 to 18 June, 1925.** — About twenty representatives of overseas Governments attended this Conference, which was called by the Secretary of State for the Colonies, at the request of the Imperial Bureau of Mycology. Among the papers read the following may be mentioned : Dr G. A. K. MARSHALL : The objects and the organisation of agricultural entomology ; — Dr. T. W. MUNRO : Organisation of Forest Entomology ; — G. B. WILLIAMS : Entomological Organisation in Egypt ; — T. J. ANDERSON : Insect Pests in Kenya ; — H. H. KING : The instruction and training of the agricultural entomologist. (*The Times*, London, 15 June 1925).

969. **Ninth Congress of Italian Olive-Growers, Bari, 19-21 October 1925.**— This Congress was arranged by the *Società Nazionale degli Olivicoltori* and was called to consider fundamental problems connected with the improvement of olive growing and oil making. There was a large attendance of experts, olive-growers, oil manufacturers and dealers, who met at Bari from every part of Italy. In accordance with the wishes of the President of the International Institute of Agriculture, Prof. G. TRINCHIERI, Chief of Section in the Bureau of Agricultural Science, attended the Congress in the capacity of observer and expert.

At the inaugural meeting, Signor G. GRASSI, President of the National Society of Olive-Growers, in the course of the address of welcome, recalled with the unanimous approval of the members of the Congress, the resolution arising out of his own proposal and passed by the Seventh International Olive-Growing Congress, Seville, December 1924, viz. that the International Institute of Agriculture should concentrate international enquiries on the Mediterranean varieties of the olive.

The principal subjects treated were : Old and New problems of olive-growing and oil-making ; practical measures for their solution. — The temporary importation of olive oil. — The growing of the olive from seed. — Observations on the susceptibility of the Bari olives to the fly (*Dacus oleae*). — Control of the olive fly in the season 1925. — Freights in the oil trade, transport in general, empty barrels, packing material, the export trade. — Wider use of table olives. — The protection of olive plantations. — Pruning and fertilising of olive-trees. — New processes of extraction of oil from the husks. — New data on the biology of the *P[illegible]*.

On the conclusion of the Congress, an interesting excursion was made to the agricultural colony of Andria.

The tenth National Olive-Growers Congress will be held in Sardinia. For particulars apply to the "Società nazionale degli Olivicoltori", Via della Panetteria 17, Rome.

970. **Italy. Fifth National Forestry Congress and National Forestry Exhibition, Campobasso, 10-12 September 1925** — [illegible]

ver at this Congress, the International Institute of Agriculture appointed Dr. G. BORGHESANI and in this way a new phase in the activities of the Institute has been entered on, with a policy of taking part regularly in the work of the most important congresses, whether national of international, which deal with agriculture.

After the inaugural speeches, the Congress, opened with the report of Prof. A. SERPIERI on the main lines of the new forestry legislation in Italy (*Direttive della nuova legislazione forestale in Italia*) and in this connection the Congress after considerable discussion fully approved the principles of the Royal Decree 30 December 1923, on the reorganization and reform of the legislation in regard to woods and mountain lands. Prof. G. JOSA dealt with the conditions for a wide and effective scheme of Forest Policy (*Condizioni per una più vasta ed efficace politica forestale*) and in the discussion which followed Prof. CORTESI advocated the exploitation of certain mountain products and proposed a statistical enquiry on the profits to be obtained by the mountain populations by growing aromatic and medicinal plants. Prof. A. POVARI read a paper on the technique of reafforestation according to the most modern views and experiments; Comm. M. DE RENDIS reported on the question of Woods and Civic Rights of Enjoyment (*Boschi ed Usi Civici*) in regard to the application of the Royal Decree Law of 23 May 1924 on the reorganisation of these civic rights of enjoyment; Prof. A. TROTTER on the Improvement of the Pasture Lands of the Southern Apennines; Prof. G. DI TOLLA on Mountain Improvement Works and Regulation of Torrents; Prof. L. PICCOLI on Modern Technical Forestry Principles.

It was decided to hold the next Congress at Florence.

The First National Forestry Exhibition which was arranged on this occasion was divided into seven sections: Sylviculture and Forestry Instruction — Forest Industry — Mountain Pastures — Special Exhibits — Improvement of Mountain Land — Agricultural Show of the Southern Apennine — Hunting and Fishing.

For particulars regarding the Exhibition: Cattedra di Agricoltura of the Province of Campobasso (Palazzo Provinciale).

971. **Italy: National Land Improvement Congress. Naples, 3 to 5 September.** — Representatives of the Ministries concerned, attended the different Consortia, Institutes, public bodies, various associations and firms interested in the subject of land improvements. The International Institute of Agriculture, on the initiative of the President and as is being done in the case of other important conferences of the kind, sent in the capacity of observer, M. E. Morales Fraile, Ing. Agr., of the Bureau of Agricultural Science. The Congress was held on the occasion of the Land Improvements Exhibition (16 August to 10 September), among the exhibitors in which were the Ministries of Public Works, of the Colonies, National Economy, and the Interior, as well as 50 *Consorzi di bonifica*, 15 private land improvement associations, 15 various bodies, two banking institutions and four manufacturing firms. The exhibits included graphic representations, relief photographs and models of hydraulic apparatus, of material for controlling malaria, etc. in other words everything necessary to give a clear idea of the active work done in land improvement in the different parts of Italy and in accordance with the various

systems. It is suggested, if the Exhibition proves a success, to make it permanent, and to bring it in the meantime to Rome.

Two lectures were given in advance of the Congress: Ing. M. MA[illegible]: Hydraulic technique in the land improvements of the South as compared with that of the North of Italy; Comm. C. VELLE, President of the *Associazione Nazionale delle bonifiche*: Results of constructive land betterment schemes (*bonifica integrale*) in relation to the Exhibition and the Congress.

The Congress opened with the Lecture delivered by His Excellency Sig. PEGLION, Under Secretary for Agriculture to the Ministry of National Economy, on "Land Improvement and Fisheries", followed by His Excellency Sig. BELLUZZO of the Milan Polytechnic and Minister of National Economy, on the Progress, in the Use of Hydraulic Machinery in Land Improvement: this latter illustrated by slides.

Other subjects treated were: Professor ASIMONTI: Land Improvement Large Scale Schemes in the South of Italy. Economic, Technical and Demographic Considerations as influencing procedure; Prof. D. TOLLA: Improvement of Mountain Land and the Treatment of Mountain Catchment Areas; Avv. A. SULLAN: Private Improvement Schemes; Ing. P. CASINI: Irrigation in the Improvement Zones of the South of Italy; Prof. G. GOSIO, Director of the Bacteriological Laboratory of the Department of Health: Improvements and Malaria; Prof. GIANDOTTI: Hydrographical Work in relation to Improvements; Prof. F. BREDIA: Meteorological observations in relation to enquiries in view of Improvement Schemes; Prof. G. BRIGANTI: Fruit-Growing; Prof. MAROZZI: Legislation on Land Improvement and Reclamation.

Seven groups of conclusions were submitted for the approval of the Congress, the greater part referring to legislative provisions on agricultural credit in connection with the improvement carried out by private persons; another making request for study of irrigation and experimental plots in connection; others referring to the diffusion of information on the methods of combatting malaria and of securing the hygienic condition of rural buildings. The most important resolutions, however, were those on legislation relating to land improvements, and certain amendments of the SERPIERI legislation are invited, more particularly that expropriation of lands be carried out only as against those landowners who do not propose to make improvements on their lands although there are special reasons for doing so of which due notice has been given; that an association (*consorzio*) of landowners has prior right in the matter of concessions for improvements of areas; that notifications, whether of the scheduling of an area for improvement, or of the application for a concession made by third parties or of any matter which may concern the landowners in this connection, shall be made to the owners by recognised legal means.

During the Congress more than thirty publications were distributed with reference to improvement schemes, already carried into effect by various bodies. The report of the Congress will be published by the *Federazione Nazionale delle Bonifiche* (Padua, Via Manin 14).

97?. **Italy: "Convegno del pesco", Canale d'Alba, Cuneo, 16-19 July 1925.** — The following subjects were discussed: — Prof. G. BELLUCCI: Peach products in the present and in the future; — [illegible] ALLEG[illegible]: The cultivation of the peach in the Ravenna district; —

The cultivation of the peach in Liguria ; — Dr. BARBARA : The varieties of the peach and their characteristic advantages for trade or manufacture ; — Prof. BOGLINO and FERRARIS : Diseases of the peach tree and treatment ; — Dr. FERRIO : The fertilising of the peach ; — Comm. CASSON : Commercial possibilities transport and packing ; — Comm. CANONICA : Preservation, marketing conditions and foreign competition. Industrial use of the peach. Local transport, shortage, measures adopted.

On the occasion of the Conference a Sample Fair was also organized of the products of the district. For further information apply to the Cuneo Chamber of Commerce and the provincial agricultural authorities.

973. **Italy : Industrial Week of experts and persons engaged in the Chemical and allied Industries. Turin, June, 1925.** — The occasion of this was the National Exhibition of Pure and Applied Industrial Chemistry, held also in Turin in May and June last. In alternation with the meetings, visits were paid to industrial establishments and the programme was divided into six sections : 1. Breadmaking, milling ; 2. sanitation industries ; 3. leather industries ; 4. oils and derivatives, synthetic resins, essences, perfumes ; 5. textile and dyeing industries ; 6. wine-making. As regards the three sections directly connected with agriculture, the principal subjects treated and papers read were the following : Ing. F. PAGLIANI : Cleaning of grain by decortication ; — Prof. Dr. S. CAMILLA : The Need for the establishment of a Royal Experiment Station for Food Industries at Turin ; — Prof. Dr. C. REMONDINO : Gathering and Distillation of Wild Aromatic herbs ; — Prof. A. PAROZZANI : The work of the Royal Experiment School for the manufactories of essences and derivatives of citrus fruits in Reggio Calabria, and for the preparation of the essential oils ; — S. E. T. ROSSI : The activity of the Subalpine Wine makers' Club (*Circolo enofilo subalpino*) in its fortieth year of existence ; — A. MARESCALCHI : Importance and future prospets of export of Italian wines ; — Dr. E. GARINO-CANINA : Wine vinegars : contribution to the chemical study of the acetic fermentation of wine ; — Prof. P. VOGLINO : Phylloxera and its spread in Italy ; — Prof. G. CHIEI COMACCHIO : Wine-making ; — Prof. Dr. F. GARELLI : Possibility of producing alcohol as a beverage from the residues of wine-making ; — Dr. G. VANNI : Sweet filtrates.

For information apply to Dr. MASSIMO TREVES, General Secretary of the "*Settimana industriale*", Via Ospedale 20, Turin.

974. **Italy : Congress on Vines and Wine. Trento, 24 June 1925.** Ing. GRAMATICA and Dr. ZUFFMANN presented reports on general enological subjects and on special treatment of wines investigated by the Experiment Station connected with the Agricultural Station of S. Michele all Adige (Trento). — Prof. G. BONI dealt with the restocking of vineyards with the European varieties on American stock, and M. GENNARO DE KRENHENBERG spoke on hybrid wines for breeding.

975. **Italy : National Congress of the Sugar and Alcohol Industries. Ferrara, 31 May 1925.**

976. **Italy: Third National Congress of Tobacco Growers. Bologna, 25 May 1925.** — This Congress was called by the Italian Federation of Agricultural Syndicates. The members of the Congress considered it essential to invite the Government to establish and bring into speedy operation,

centres for experimental work in districts where the cultivation of tobacco
stands in need of such centres, and particularly in the valley of the Po, the larg-
est and most recently developed centre of production. In addition, the Min-
ister of Finance should place persons who have obtained tobacco concessions
in a position to meet the requirements of the Italian manufacturers by means
of an increase in technical staff and in other ways. Later on a vote was pas-
sed for the formation of a tobacco export Company and a further meeting will
be called to arrange its organization. (*La Terra*, Year I, No [illegible], Bologna, 1925).

Exhibitions, Fairs, Competitions.

977. **Italy : International Competition of Viticultural Machinery, Barletta.** — The Minister of National Economy announces an international competition, open to makers of implements and machines adapted for the plant-ing and cultivation of vineyards. The competition will be held at the Barletta *Cantina Sperimentale* from 15 April to 15 June 1926. Applications for entry must be addressed to the Director of the Barletta *Cantina Sperimentale* not later than 31 January 1926.

978. **Argentina : International Exhibition of Hygiene, Art and Industry. Rosario, 5 December 1925, 5 March 1926.**

979. **Cuba : International Sample Fair, Havana, December 1925.**

980. **France : International Exhibition of the "Société des Avicul-
teurs du Nord". Lille, France, 12-14 December 1925.** — For information:
M. René Parent, 32 bis, rue du Vieil-breuvoir, Roubaix (Nord).

981. **Great Britain : British Empire Exhibition. Wembley Park.
London, April to October 1925.** — For information : Director United King-
dom Exhibits, Administration Buildings, Wembley.

982. **Belgium : Eighth International Poultry Fair. Brussels, 5 to
7 September 1925.** — This fair was organized under the auspices of the City
of Brussels and under the honorary presidency of the Deputy Maréchal,
President of the International Poultry Federation. A well equipped commer-
cial section, the object of which was to encourage the culture and the impro-
vement of all material and fittings, required for the poultry industry, displayed
a large number of stands of special kinds of feeds, as well as those in ordinary
use. For information apply to the Secretary of the Organising Committees
of the *VIIIème Foire internationale avicole*, 305, Chaussée d'Anvers, Bruxelles.

983. **Bolivia : International Manufactures Fair. La Paz, August 1925.**
1925. — Organised on the occasion of the centenary of the Bolivian Republic.

984. **Fifth International Exhibition and Fair. Riga. 19 July-
31 August 1925.**

985. **International Sample Fair. Bandoeng. 20 June-4 July
1925.** — For particulars : Nederlandsch-Indisch Jaarbourg, Menade Straat,
Bandoeng.

986. **France : International and Colonial Sample Fair. Bor-
deaux, 15-30 June 1925.** — For particulars : [illegible]
du Maréchal Joffre, Bordeaux.

987. **Second International Book Fair. Florence, 30 June 1925.**

988. **Italy: First International Exhibition of the Gas and Water Industries. Padua, June 1925.** — Held on the occasion of the 51st Congress of the Italian Gas and Water Companies.

989. **Finland: Sixth International Finnish Fair. Helsingfors.** — For particulars: Finlandska Massa A.B. Frederiksgatan 14, Helsingfors

990. **Germany: XXXIst Travelling Exhibition of the German Agricultural Society, Stuttgart, Wurttemberg, 18 to 25 June 1925.** — The *Deutsche Landwirtschafts-Gesellschaft* which has undertaken to organize every year a show of live stock, agricultural produce, farm implements and machines, in different localities in respective years, held its "40th Travelling Meeting" in Stuttgart in June last, following, as usual, the headquarters of the travelling exhibition. Wurttemberg is the birthplace of the founder of the Society, MAXIMILIAN EYTH, who in 1896 organized and managed the first exhibition of the Society in Stuttgart.

On the occasion of this 31st travelling Exhibition the *Münchner Neueste Nachrichten* has published a special supplement with a number of articles, among them one by Ing. FRITZ BRUTSCHKE (Zehlendorf, Berlin) giving an account of the activity of the *Deutsche Landwirtschatts-Gesellschaft* in regard to these travelling exhibition and the practical results obtained.

Another article is by Dr. FELIX JALK on agriculture in Wurttemberg; and another by the advisor to the Ministry, PAUL SUSKIND, on the promotion of stock-breeding in Bavaria. A fourth is by the Advisor to the Ministry, Dr NIKLAS, on the stock-breeding industry in South Germany, and two further articles are respectively by Dr. LANG of Munich, Chief Advisor to the Ministry, on the instruction in agricultural machinery given in Bavaria, and by CHRISTMANN, Director of the Bavaria Institute for Plant Cultivation and Protection, on the progress in technical agriculture. (*Münchner Neueste Nachrichten*, No. 166, 17 June 1925)'.

991. **Austria: Fundamental Criteria for the Judging and Awarding of Prizes to Cattle in Lower Austria.** — Up to lately periodical judgings of bulls and calves have been carried out at all the stock-breeding centres in Lower Austria. Every owner of stock had the right to present his animals for inspection, even if they were not bred by himself. Only one or another of the head of cattle presented were examined, and when the stock from a given farm failed several times to come up to the standard required by the Judging Committee, recognition was refused.

This form of cattle show viz. exclusively for calves, is now altogether given up, as it was considered that, in the absence of evidence as regards progeny and functional aptitudes, the judging tended to be based purely on conformation and thus not infrequently led to disappointment at a later period of the animal's history. Hence, at the present time instead of calves only, there are presented for examination young and full grown animals, cows, beef cattle, and heifers. Only animals registered in herd-books and their descendants can be approved.

In this way it becomes possible, as it was not before, to judge and form an estimate of the stock-breeding farming activities of each member of the association. There is in addition a new prize award scheme, which brings into more prominence the evaluation of hereditary characteristics and facilitates the

awarding of the prizes in classes corresponding to the points of the animal shewn.

Prizes are being awarded by the Lower Austrian Chamber of Agriculture and the Federal Ministry of Agriculture : and also there will be prizes given by the rural district chambers, the associations and the Communes : these will however be of less value than those given by the two first named bodies. The judging is carried out by a sworn Committee appointed for the purpose. Farmers who have an official position in the association or reside in the administrative area of the association cannot sit on this committee. Members are proposed by the Lower Austria Chamber of Agriculture and the Provincial Government appoints a member in its turn.

For the awarding of prizes note is first taken of the evidence produced by the exhibitor in respect to the progeny and the functional aptitudes of his animals and only after that is judgement given on each animal and in accordance with a given scheme, established by Decree of the Provincial Government on the basis of the Law on the promotion of stock-breeding. This scheme provides for four groups, further divided into sub-groups, represented on the following table in regard to the maximum number of points obtained.

Head and Neck	5
Back Line and width of back	4
Forequarters, width of chest behind the shoulders barrel, shoulders	4
Hindquarters, croup, width of thigh, muscles, sex organs	4
Length of body	5
Structure of limbs and general bearing	4
Skin and hair	3
Milk-yielding aptitude	14
Meat producing aptitude	8
Work aptitude	5
Breed and coat	10
Progeny	8
Condition of health and constitution	7
Development	10
General impression	

Animals obtaining more than 85 points receive the first prize, those obtaining from 80 to 85 points receive the second prize, and cattle with [illegible] to 80 points receive the third prize. For animals for which there is evidence forthcoming, authenticated by the Association, in respect of the sire and the dam, and evidence, similarly supported, as to the milk-yielding [illegible] of the dam, for at least two years, the owner receives an extra prize of [illegible] % given by the Provincial Chamber of Agriculture. The prize is subsequently [illegible] by 50 %, when the breeder can bring forward evidence in respect to the pedigree of the animal presented.

The acceptance of the prize binds the breeder to [illegible] the animal presented to breeding purposes for the space of at least two years. Young prize

bulls must be sold only to farmers or Communes who undertake to place them at the disposal of the public breeding stations in the territory of Lower Austria for the space of at least one year.

The lower Austrian Chamber of Agriculture has the exclusive right of purchasing animals winning the prizes it awards. If the exhibitor puts the animal to uses other than those to which he is bound by the award, he must restore the prize, and also incurs a fine equal to half its value. The object of this proviso is to prevent the breeder from selling the animal and to oblige him to use it for the purpose of improving the breed.

In addition to these prizes for individual animals, others are offered for whole families of animals shown : the cow and at least five descendants. Each exhibitor may claim for his animals of one group only one prize, but for any remaining animals that reach the prize standard he may receive a certificate stating the nature of the prize they would have taken.

Besides these approval exhibitions, others are organized for bulls, and the special purpose of these is to provide a classification of the stock for the Stock-Breeding Committees, and to afford the Communes the opportunity of purchasing approved and prize animals for service uses. As regards organization and the award of prizes the same rules are followed in these exhibitions as in the former kind. The acceptance of a prize binds the breeder to devote his bull to breeding purposes only for a period of at least a year, or to hand the animal over only to an individual purchaser or organisation which will undertake to put it for the period of at least six months to the disposal of the public breeding stations of the territory of Lower Austria. The total amount of the prizes is fixed year by year by the regional Chamber of Agriculture.

This new scheme for approval of cattle has been very generally adopted in Lower Austria, although imposing much stricter conditions on the breeders than formerly. (STAMPEL, Prof. of Alpine Cultivation at the Vienna Higher School of Veterinary Science : reporter on Stock-breeding to the Lower Austrian Chamber of Agriculture. Genossenschaftliche Rinderschauen in Niederösterreich. *Die Landwirtschaft*, No. 1, Vienna, 1925. — Bestimmungen über die Abhaltung von Rinderschauen in Niederösterreich. Grundsätzliche Weisungen herausgegeben von der Landes-Landwirtschaftskammer in Wien, 1924).

902. **Austria : The part taken by agriculture in the Vienna Fair and the Principles regulating it in Lower Austria.** — The Lower Austrian Chamber of Agriculture has since the autumn of 1923 taken a definite part in the organisation of the Vienna Fair both as regards the sectional and the special exhibitions. On the basis of the experience so gained, the following principles have been laid down for participation in future fairs.

1. The organisation of an agricultural and forestry exhibition is essential for the development of Austrian agriculture ;

2. The arrangement in the separate sections should be such as to illustrate clearly the aim of facilitating the marketing of produce, the locality from which the exhibit comes being a secondary consideration ;

3. With a view to inducing farmers to take part in the exhibition and to general encouragement of agriculture, special competitions and prizes will be arranged in the separate sections ;

4. So far as proves possible the exhibition is to be extended to the separate branches of the stock-breeding industry on the larger scale, thus including competitions for cattle and horses, the exhibits of live stock having been so far confined to rabbits and poultry.

5. Products of special excellence in one or other field of rural activity will receive appropriate certificates of merit, granted by the Chamber of Agriculture in accordance with the proposals of the competent committees;

6. As a basis of action, arrangements will be made for the supply at the Fair of special information, particularly in respect to demonstrations of implements and machines, lectures, lantern slides, cinematograph displays bearing on agriculture, to be given or held in the premises of the exhibition;

7. By agreement with the holder of the Chair of Agricultural Mechanics at the Vienna Higher School of Agriculture, competitions will be held annually for groups of machinery (in 1924 one will be organised for spraying machines) which after approval will be on show in the exhibition;

8. Special stands will be assigned for the display of these exhibits.

The Lower Austrian Chamber of Agriculture has decided to concentrate interest as regards exhibitions, solely on the Vienna Fair, promoting only in exceptional cases small exhibitions in separate districts which usually only result in dissipation of energy. (LOSOBNIG, reporter for fairs and fruit growing to the Lower Austrian Chamber of Agriculture. Referat uber landwirtschaftliches Austellungswesen in der Vollversammlung der Landeslandwirtschaftskammer am 30 Oktober 1924. *Mitteilung der Landeslandwirtschaftskammer*, No. 7, 24 November 1924, 2 pp., Vienna).

993. **Brazil : Agricultural Livestock Exhibition, 1925.**

994. **Brazil : 1st Exhibition of Milk and its Derivatives, St. Paul, 12-20 October 1925.** — Organised through the initiative of the National Society of Agriculture.

995. **Bulgaria : Stock Breeding Exhibition, Rasgrad, Autumn, 1925.** — Organised by the Permanent Committee of the Departmental Council of Roussé.

996. **Chile : Pomological Exhibition, Santiago, March 1925.** — Through the initiative of the Agricultural Society and with the help of the Chilean Ministry of Agriculture.

997. **France : VIth Competition for the finest ear of corn in France, Bordeaux, October 1925.** — Three sections : very early variety, early variety, late variety. For particulars apply to : 6th Competition for the finest ear of corn in France, Palais de la Bourse, Bordeaux.

998. **France : Exhibition of Agricultural Tractors, Buc, Versailles, 29 September to 4 October 1925.** — By decree of 11 June 1925 the French Ministry of Agriculture arranged an exhibition of agricultural petrol tractors [illegible] of agricultural gasogene, charcoal and wood tractors and [illegible] of charcoal gasogene trucks and tractors, of apparatus for the manufacture of charcoal in forests and on the farm, of vegetable oil motors and electric [illegible]. The Exhibition was organized by the Ministry of Agriculture (Central Committee of Mechanical Agriculture) with the collaboration of the Ministry of War and the Departmental Agricultural Office of Seine and Oise.

999. **France: The Lower Rhine Horticultural Exhibition Strassburg, June 1925.** — Organised through the initiative of the Société d'Horticulture du Bas-Rhin, which has celebrated its 80th anniversary.

1000. **France: Gastronomic Fair. Havre, 11-20 April 1925.** — The fair has, among other things, demonstrated particularly the important progress made in France in the refrigerating industry applied to the preservation of food.

1001. **France: Competition for the selection of the black spotted Breton breed for the Departments of Finistère and Morbihan (France), 1925.** — This competition has been organised by the Agricultural Academy of France by means of the bequest of the late Baron GERARD. For particulars as to the bequest see the *Current Notices* of the last number of this Review.

1002. **Great Britain: Textile Machinery Exhibition. Manchester, 2-17 October 1925.** — For particulars apply to *Organisers of the Textile Machinery and Accessories' Exhibition, 121 Deans Gate, Manchester.*

1003. **Great Britain: Annual Sanitary Exhibition. Edinburgh, 20-25 July 1925.** — In conjunction with the 36th Congress of the Royal Sanitary Institute (90 Buckingham Palace Road, London, S. W. 1).

1004. **Great Britain: National Commerce Exhibition. Liverpool, 6-25 July 1925.** — For particulars apply to: L. BATLEY, Esq., Gorsey Works, Stockport.

1005. **Canada: Canadian National Exhibition. Toronto, 25 August to 12 September 1925.** — For particulars apply to: The Secretary, Lumsden Buildings, Toronto, Canada.

1006. **Italy: National Land Improvements Exhibition. Naples, August 1925.** — This Exhibition was organised, by a resolution of the Council of the Ministers, on the proposal of the Ministry of the Public Works, the Hon. CIURIATI, of the « Federazione Nazionale delle Bonifiche ». For particulars apply to: Federazione Nazionale delle Bonifiche, Rome, Piazza San Marcello (Galleria), or Padua, Via Daniele Manin 14.

1007. **Persia: Agricultural Exhibition. Teheran, August, 1925.**

1008. **Czecho-Slovakia: Agricultural Exhibition. Prague, 15-21 May 1925.** — Interesting on account of the introduction of agricultural machinery which occupied more than half the Exhibition space out of a total of about 5 acres. 2,000 people took part in addition to 360 delegations, and 40,000 people visited the Exhibition.

1009. **Turkish Floating Exhibition, sailed July 1925.** — Organised on the "Kara Deniz", the largest steamship of the Sefain Navigation Company. Called at the principal ports in the Mediterranean, England and the two Americas. Among the products exhibited and of interest to agriculture were: cotton, tobacco, olives, nuts, figs, grapes, dried fruits, sesame, opium, attar of roses, honey, forest products.

Development of Agriculture in the different countries.

1010. **Austria: Reafforestation in Lower Austria.** — During the war and the difficult years which followed, there was much disafforestation. Owing to the shortage of young trees, and owing to the fact that disafforested tracts

had been given over to pasture, reafforestation was necessary over vast areas. The Lower Austrian Chamber of Agriculture, in order to remedy the shortage and to meet the threatened danger of depletion of the forest regions, has established new nurseries, and revived and enlarged those already in existence, so that at the present time it is able to supply forest trees at production cost. Proprietors of small woods who undertake to reafforest bare and sterile lands under the direction of competent persons, and to give them up entirely to forest culture and hence to protect the forest species, receive grants from the Chamber of Agriculture of firs, larches, pines, acacias, ash-trees, alder-trees 2 or 3 years old. When a sufficient number of trees are available, there will also be a distribution for the purpose of improving regions insufficiently wooded. It is hoped during the next few years to develop further the work of reafforestation, which is of such importance in the reconstruction of forests. (ADAM, public advisor and reporter for forest culture to the Lower Austrian Chamber of Agriculture, Waldplanvenverteilung 1925. *Mitteilungen der Landeswirtschaftskammer*, No. 7, 4 November 1924, Vienna).

1011. **Development of Agriculture in Brazil in 1924.** — *Coffee*: The cultivation of this product is always of great interest to growers, on account of the high prices at which the crop is quoted. Large numbers of workers also are attracted by the amount of work offered, and by the richness of the regions under coffee plantation, and a considerable migration of labour thus takes place. The 1924-25 crop is, however, less than those of previous years, being estimated at 755,075,000 kilos, while in 1923-24 it rose to [illegible] kilos and, in 1922-23 to 1,140,435,445 kilos. In the States of S. Paulo, Parana, Minas, Rio de Janeiro, Espirito Santo and Bahia, new coffee plantations have been established, thus increasing the area given up to coffee. This area would be still larger, if more labour were available. Great anxiety is shown to profit by the present favourable moment, occasioned by the high value of the product. *Stephanoderes coffea* appeared in the State of S. Paulo, but was successfully controlled by direct as well as by prophylactic measures.

Sugar : The technical problems of the sugar industry are suffering from want of a definite policy. The improvement in the equipment of the factories finds no parallel in the improvements on the agricultural side, which would be inseparable from the introduction of new varieties of canes richer in saccharine properties, more productive, and more resistent to disease and infection.

Rice : The last crop was somewhat inferior to those preceding. The Central states suffered from a prolonged drought, and irrigation is not yet generally adopted. Throughout Brazil half a million hectares are under rice, and it is calculated that the production of 1924 was about 770 million kilos.

Tobacco : The cultivation of this plant was not very satisfactory owing to insufficient rains. Bahia continues to hold first place, especially for leaves grown for exporting. In Rio Grande do Sul plantation of high grade varieties are being extended, and the amount exported is therefore increasing.

Cocoa: The State of Bahia holds first place in the growth of this crop, but the production cannot be adequately developed without more labour and in the absence of agricultural credit. The State of Bahia comes next, but far behind, and then the State of Espirito Santo where cocoa plantations are being established along the valley of the Rio Doce.

Rubber : In view of the high prices of this product, interest is being directed to an investigation of Brazilian rubber, especially after the optimistic Report of the North American Commission which went to Brazil in order to study the whole question.

Wheat : The area under cultivation is increasing. The Government has taken action to promote the selection of seed and the introduction of exotic varieties which are more suitable to the different regions of Brazil. To this end there are two special experiment stations one in Parana (Ponta Grossa), and the other in Rio Grande do Sul (Alfredo Chaves). The latter is under the direction of a Swedish tecnician, Doctor IVAN BECKMANN, late of the Institute at Svalof, who was invited by the Brazilian Government to direct the work in cereal genetics.

Rye : The cultivation of this crop is increasing, especially in the States of Parana and Santa Catharina, where conditions are very favorable.

Vines : Cultivation continually increasing. (Mensagem apresentada ao Congresso Nacional na abertura da segunda sessão da decima segunda legislatura pelo Presidente da Republica ARTHUR DA SILVA BERNARDES. *Diario Official*, May 1925).

1012. **Brazil : Coffee Plantations in the State of São Paulo.** — Following the official data contained in the publications of the Agricultural Secretariat and more especially in 2 volumes " O café " and " Os municipios paulistas ", the *Gazeta da Bolsa* of Rio de Janeiro (VIII, No. 7, 1925) has compiled 2 tables of data, which show that in the ten-years period between the agricultural seasons 1913-14 and 1922-23, there were in the State of São Paulo 54,200,000 productive coffee plants, while 16,200,000 plants became unproductive.

1013. **Brazil : The Coffee Plantations of Parana.** — Signor E. GRILLO, assistant to the phytopathological service of the Institute for the Protection of Agriculture (*Istituto de Defensa agricola*), acting under instructions from the Federal Ministry of Agriculture, has carried out an investigation in the coffee plantations of the State of Parana with respect to the existence of the *Stephanoderes coffeae* Hag. The insect was not found ; the season was not however particularly appropriate for such an investigation, since the fruit was still very unripe, and did not offer a favorable environment for the *Stephanoderes* in its different phases. However, the appearance of the parasite is reported in the State of São Paulo, and a service of disinfection is proposed at the frontier, for all sacks passing from this State into Parana, as well as measures for the protection of coffee based on those proposed by the entomologist Doctor CARLO LIMA for the State of Espirito Santo. *A Gazeta da Bolsa*, VIII, No. 9, 1925 publishes the report drawn up by GRILLO on this inspection of the coffee plantations of Parana.

1014. **Hong-Kong : Camphor Plantation.** — The Department of Forestry of Hong-Kong is entering upon an enterprise of great interest, viz. a camphor plantation. For this purpose a small valley near Little Hong-Kong is being utilised which has hitherto borne a nearly virgin forest. All the trees which are fit only for timber are being cut out. Some very fine mature specimens of *[illegible]* are to be seen. There are also many splendid trees of a

wide-leaved species of *Cinnamomum* reputed to be very productive of camphor gum. (*Lingnam Agricultural Review*, Vol. 2, No. 2, Canton, 192[illegible].)

1015. **India: Progress of Cultivation of Improved Varieties of Crops.** — In the annual report of the Agricultural Advisor to the Government of India he states that the area under cultivation with improved crops has increased in the relatively short period of 18 years from some thousands to millions of acres. In 1923-24 five million acres were under cultivation with improved crops originally selected by the Agricultural Department, *viz.* 606,603 acres for rice; 1,398,885 acres for wheat; [illegible] for sugar-cane, [illegible] for cotton; 210,262 for jute; 467,140 for other crops. Allowing an additional profit per acre of 10 rupees, obtained by the adoption of these improved varieties, it is reckoned that the annual value of agricultural production in India is increased by three and a half millions sterling. It is hoped to obtain an even larger additional profit in the future. (*The Times Imperial and Foreign Trade and Engineering Supplement*, Vol. XVI, No. [illegible], 192[illegible].)

1016. **Nyasaland: Note on Cotton Growing.** — 1. *Times of planting cotton*: (*a*) Lower Shire Districts: Elevation below [illegible] ft. above sea-level, mid-January to mid-February.

(*b*) Upper Shire and Lake areas. Elevation [illegible] ft. to [illegible] ft. above sea-level: beginning to middle of January.

(*c*) Palombe plain and similar elevations of [illegible] ft. to [illegible] ft. above sea-level: beginning to end of December.

2. *Times of picking*: (*a*) and (*b*) get two flushes of fruiting (bolling) in normal years: the first in June to July, though some years earlier than this; the second in October to November.

In the intervening period which corresponds with the coolest and driest months of the year, the plants lose their leaves and acquire a new set.

(*c*) Normally, only gets one flush, the second flush on account of the colder conditions, being too late to allow it to be picked in time for the land to be cleared and cultivated for the next crop. On an average of seasons the difference in yield between the above mentioned areas is in favour of (*b*) and (*c*), but not to the extent which might be imagined from the natural advantages they possess, the boll-worm and the internal boll disease restoring the balance.

3. *Labour conditions, supply and quality*: Labour, except during the season when the natives are engaged with their own food crops, is plentiful and the food supply is normally very good.

The African native is only now arriving at the stage of thinking in terms of regular work.

Under the European employer the "Task" system is nearly universal and this does not lead to efficiency. The native, with his own crops, is too apt to procrastinate and the crops suffer in consequence.

4. *Transport*:—

(1) Railway from the Shire Highlands to Port Herald.

(2) Central African Railway from Port Herald to Chindio on the Zambezi.

(3) Ferry across the Zambezi.

(4) Trans-Zambesia Railway to Dondo Junction on the Beira-Mashonaland Railway.

(5) And by the latter railway to Beira and to the sea.

This complex and unwieldy system forms the main line of egress for the produce of the country.

It is liable to more or less complete stoppages when the Zambezi floods each year and is at all times handicapped by the lack of proper harbour facilities at Beira, the present arrangements being easily overwhelmed by the traffic: the said traffic being that of the Rhodesia and part of the Congo besides that of Nyasaland. The Railway in Nyasaland is fed in three ways:

(1) Head transport.

(2) River transport (Lower Shire only)

(3) Road transport (subdivided into: (*a*) Ox-cart transport; (*b*) Mechanical transport).

All the above have their uses and their limitations:—

(1) is becoming unpopular with the natives;

(2) is limited to the time when there is sufficient water in the river to float the barges, i. e. in the rains or just after;

(3*a*) is slow, and impossible wherever tsetse fly occurs;

(3*b*) is expensive in vehicles, their upkeep and the running expenses.

The time taken from Plantation to Port is a most elastic period, everything depending on the weather, time of year, traffic on the Beira-Mashonaland Railway, etc.

The shortest possible time on rail for goods is about 5 days: and the longest is indefinite: the writer has had to wait six months for a motor-cycle to come up from Beira.

5. *Prevalence of the Red Boll-worm* (*Diparopsis castanea*). — This pest occurs, together with the American Boll-worm and the Spiny Boll-worm, throughout the Protectorate, ranging from an elevation too high for the productive growing of cotton to the lowest elevations in the country, 150 ft. or so above sea-level. The Red Boll-worm is a pest occurring throughout the season, but mainly in the early part, i. e. in the muggy moist weather. The American Boll-worm is more a late season pest, since while other crops are green, it seems to prefer them to cotton. The Spiny Boll-worm occurs in larger or smaller numbers throughout the season. All pests however fade into insignificance beside the Red Boll-worm.

6. *Characteristics of Nyasaland cotton and expected improvements from the work in progress.* — The present commercial bulks of Nyasaland cotton are the degenerate descendants of a number of introductions of the Allen Long-staple type of Upland cotton. Apart from their objectionable characters from a crop point of view, e. g., small bolls, large, long-jointed, straggly plants, etc. they are undesirable from a lint point of view. Very few bulks will gin more than 20 % to 30 % and even with this low ginning percentage much of the seed is very light, i. e. below 10 grams per 100 seeds. The lint length is very irregular in the same sample, in most cases ranging from half an inch to one and a quarter inch. With the large amount of rotting due to boll-worm and to internal boll-rot, much of the lint tends to be weak.

It is expected that from the large collection of new introductions and se-

lections of Nyasaland cotton which have been accumulated it will be possible to separate out a strain, or strains, which will yield better than the existing bulks of commercial cotton in the country. It is too early to prophesy yet what the value of rotation crops may be.

7. *Advantages of the rough leaf and hairy type of plant over the existing type.* — A decided resistance to Jassid attack; smooth plants as soon as the leaves appear, redden and dry up with the onset of the dry season. Over those plants of the existing type that are hairy there is of course no advantage from this point of view.

(*Correspondent Nyasaland*).

1017. **The Oil-Palm Industry and West Africa.** LUGARD, SIR FREDERICK (G. C. M. G., C. B., D. S. O). *Tropical Agriculture*, Vol. II, n. 6, pp. 119-121, Trinidad, 1925.

The author draws attention to the oil-palm industry of Nigeria and the danger with which it is threatened, in common with all similar tropical countries, owing to competition from the East, particularly the Dutch Colonies.

Recent estimates give the annual output of West Africa (exclusive of the Congo) at 430,000 tons of kernels and 180,000 tons of oil, valued at £ [illegible].

The wild rubber industry was destroyed by the plantation rubber of Ceylon, Malaya and the Dutch Colonies.

The Dutch Colonies have successfully introduced the oil palm: [illegible] acres are planted and 15,000 bearing. The danger lies in the fact that the yield per tree is greater than in Africa, and a larger amount of oil of better quality is extracted, owing to the employment of scientific methods and organization. These methods contrast with those of the African native who is unable to understand the conditions of modern world competition.

If means could be found, without violation of native rights, to increase and cheapen this source of food supply and raw material for industry, no effort should be spared to achieve such a result.

The objects in view are :—

To save a threatened industry by the adoption of methods which will enable it to stand competition.

To preserve for human use the millions of tons of valuable produce now uncollected, or wasted by crude methods of preparation.

To increase output by converting to productive work the labour now wasted in archaic methods of transport and preparation of the oil.

To devote to native welfare a portion of the profits of the [illegible], and possibly by clearing, etc. (planting of efwatakala grass), to decrease the areas subject to tsetse-fly and the diseases (sleeping-sickness and cattle diseases) of which it is the carrier.

1018. **Roumania: The Development of Agriculture in Roumania as a result of Agricultural Reforms.** — These reforms, which caused a complete change in the distribution of cultivable land have had a very favourable effect on agricultural production, according to the last official figures [illegible]. Both the yield and the quality of the wheat have improved, while the yield has increased in the years 1919-23 from an average of [illegible] to an average of [illegible] quintals per hectare. Live stock production has increased [illegible] within the same period. The quantity of crop and live stock products exported, also [illegible]

creased considerably, namely, from a value of 34 million *lei* (in round figures) in 1919, to over 9 miliard *lei* in 1922.

The large estates, which, previous to the reforms, comprised 48 % of all cultivable land, only form 8 % at the present time, and the number of small holdings has doubled from 40 % to 80 %. (*La Réforme agraire en Roumanie et ses résultats d'après les derniers chiffres officiels fin 1924*, 1 vol., 23 pp., small 8º, Bucarest, 1925).

1619. **Czecho-Slovakia : The improvement of Pasture Lands in Slovakia.** — In Slovakia 12.43 % of the total area of the country is devoted to pasture, and in half of the old Slovak Komitâts pasture forms 25 % of the total cultivable area (40.9 % in the Komitât of Liptov). The largest pasture areas are to be found in the Komitâts of Zemplin, Trencin, Sarys, Liptov, Gemer, M. Hont (to an extent of 88,542 hectares in the Komitât of Zemplin).

Land is so valuable in that region that farmers are obliged to graze their animals on the less fertile tracts, which are generally mountainous.

In 1919, through a decree issued by Minister SROBAR on the utilization and improvement of pasture lands, an attempt was made to convert into pasture all lands that were not being put to more profitable use. This decree was renewed every year, but has now become law, having effect from 1924-1929. By this law farmers are required to pay a tax for the use of pasture lands, and regulations have also been made with respect to the upkeep and improvement of private pasture lands.

The Ministry of Agriculture grants subsidies towards improvements, aids farmers in the purchase of seeds and artificial manures, and loans machinery when required. Before granting subsidies, however, an inspection of the lands in question is carried out by the competent State authorities. Five experts have also been employed for this purpose since 1924, who are assisted by agricultural inspectors in each Komitât. It is impossible for financial reasons to grant all the requests for subsidies, but considerable progress has been made towards the improvement of the pasture areas of the country. (*Publication du Ministère de l'Agriculture de la République Tchécoslovaque*. Prague, 1 May 1924).

Miscellaneous.

1620. **Brazil : The "Babassu" and Derivatives Industry.** — According to the periodical *Brazil-Ferro-Carril* (Year XVI, Vol. XXVIII, No. 306, 1925) the Maranhao papers are reporting the progress of the factory established there for the preparation of the babassu nut by means of the mechanical oil-presses known as "Brito Passos". Derivatives are also prepared, the use of which was not formerly known, among them a kind of flour which should be much in request for the feeding of dairy cows, owing to its richness in nitrogen and phosphates.

1621. **Brazil : Dictionary of the Valuable Plants of Brazil.** — This is a work which Dr. PIO CORREA, a well-known Brazilian scientist, began to compile in 1905 and which therefore represents the result of many years of assiduous labour. It will eventually consist of eight volumes, in octavo, with more than [illegible] illustrations in the text and about a thousand diagrams in an appendix. The first volume has just appeared and will form an addition to

the number of works of reference which are indispensable to the science of botany and especially to systematic botany. The edition is the exclusive property of the Federal Government of Brazil, which is regulating the sale.

1022. **Chile : Nitrate Costs.** — As a result of the growing competition of the synthetic nitrogenous fertilisers with Chilean nitrate, the Minister of Finance in Chile has called a meeting of nitrate producers in order to discuss means of reducing costs of production to meet this competition. It has been suggested that economy could be effected by improved mechanical plant, better preparation and transportation methods, better facilities at the ports and co-operation between the producers and the State (*Chemistry and Industry*, Vol. 44, No. 21, London, 1925).

1023. **International Scientific Tables.** — Dr. CHARLES MARIE, general Secretary of the International Commission, charged with the compilation and publication of "*International Annual Tables of Constants and Numerical Data, Physical, Chemical and Technological*" announces the publication of Vol. 5, Part I. This volume gives the numerical data which characterize any substance, material, or system, which are to be found in the world's literature for the period of 1917-1922, inclusive, and covers the sciences of physics, chemistry, mineralogy, biology and the various branches of technology. Owing to the immense increase of modern scientific literature, these volumes will be of great value to the scientist. They give not only the data as they appear in the original literature, but also the corresponding literature reference for every value recorded.

This international undertaking is carried on without profit and is made possible by the financial support of governments, scientific societies and educational institutions which contribute to the international fund. Members of scientific organisations and of the faculties of universities which help in this way to make possible the compilation of annual tables are accorded a special discount on purchases of these volumes. (*Science*, Vol. LXI, No. [illegible]).

1024. **American Bibliography of the Natural Sciences.** — The first volume has been published in New York of a bibliography containing particulars of what has been accomplished in the field of the natural sciences beginning from the colonial period up to 1924. The subjects treated include the work done by the scientific associations, by natural history museums, botanical gardens, the Federal scientific expeditions in the various fields of mineralogy, geology, botany, zoology, palaeontology, etc. This comprehensive bibliography will be arranged on the most modern lines and a number of valuable indexes will be attached, showing authors, institutions, geographical names, etc. In this first volume, some hundred pages are devoted to a bibliography of biography, beginning with JOHN ABBOT, the ornithologist to JOSEPH ZENTMAYER the maker of microscopes. (MAX MEISEL, *A Bibliography*, New York, 1924 [illegible] dollars).

1025. **France : Promotion of Rural Engineering.** — The French *Académie d'Agriculture*, at its meeting of [illegible] February [illegible], founded a biennial prize of 2000 francs, to be awarded to the French constructor or inventor who, during the five year period preceding the award of the prize, should have made the most important improvement in the construction of an agricultural machine, the nature of which should be indicated in advance by the Academy. The prize

is to be awarded for the first time at the end of 1925, and will be given for the most important improvement made during the five years 1921-25 in the construction of a tractor plough, which can be also drawn by animals. The competition closes on 30 June 1925. (For particulars apply to the Academy, Rue de Bellechasse, Paris).

1026. **France: The Origin of Maize and the Production of New Varieties.** — On this subject two memoranda of M. BLARINGHEM have been presented by M. CONSTANTIN to the *Académie d'Agriculture* at its meeting of March 1925. Before the arrival of the Spaniards in America the Incas cultivated a large number of varieties of maize. M. CONSTANTIN has received some grains of *Euchlaena Mexicana*, which the natives regarded in accordance with an ancient tradition as the parent of maize. If transition from one genus to another is possible, it appears probable that the phenomenon may have been observed during the early history of Peru, by intelligent native observers. Señor BENTO DE TOLEDO, a Brazilian experimentor, has on his side obtained from a wild indigenous plant, referred to the genus *Euchlaena*, some plants very closely allied to those described by BLARINGHEM as degenerate maize. The study of dried material sent by BENTO TOLEDO has enabled Blaringhem to identify on the living specimen the characteristics of transition from a genus (*Euchlaena*) to another (*Zea*) by progressive metamorphosis.

1027. **France: Practical Classification of the Principal Varieties of Wheat cultivated in France and in French North Africa.** — The French Seed-Testing Committee had approved the synonymous classification of wheats by HENRY VILMORIN as the most practical. JACQUES VILMORIN has now constructed a dichotomous key for the rapid identification of wheat samples, retaining the general scheme of the fifty sections of the synonymous classification already mentioned and indicating besides whenever possible the botanical varieties recognised by Professor J. PERCIVAL (*The Wheat Plant, A Monograph*, London, 1922) and by Dr. N. I. VAVILOV (A contribution to the Classification of soft wheats, *Bullettin of Applied Botany and Plant-breeding*, Vol, XIII, No. 1, Leningrad, 1922-23).

The author has retained the division of all the cultivated varieties into seven main groups represented respectively by: *Triticum vulgare* Host; II. *Triticum turgidum* L.; III. *Triticum durum* Desf.; IV. *Triticum polonicum* L.; V. *Triticum spelta* L.; VI. *Triticum dicoccum* Schubler; VII. *Triticum monococcum* L. The other species appearing in the classification of Prof. PERCIVAL are assigned as follows: *T. compactum* (Host in the various groups of *T. vulgare*; *T. orientale* Perc. (with *T. polonicum*); *T. sphoerococcum* Perc. (with *T. vulgare*); *T. aegilopoides* Bal. (wild form of *T. monococcum*, and in its group); *T. dicoccoides* Korn (wild form of *T. dicoccum* in the corresponding group); *pyramidale* Perc. (with *T. turgidum*). In addition *T. persicum* Vav. is referred to *T. vulgare*.

The varieties cited by the author in his key are only quoted as examples. Naturally he cannot quote all the innumerable varieties already obtained and being obtained at the present time. As regards the North African wheats in particular, the authour has cited only a small number of forms, disregarding the work of BOEUF, DUCELLIER and MIEGE on the subject (*Bulletin de l'Office de Renseignements agricoles*, No. 9, 1925).

1028. **France : Electrification of the Country Districts.** — M. R. PREAUD Chief Engineer of the Department of Rural Engineering in France concludes an article on this subject by pointing out that the characteristic difficulties arising in the distribution of electric power in the country districts lie in the fact that the rural networks require a maximum of installation expenses with a minimum of receipts. For the resolution of the important problem from the financial side and for the achievement of the solution of technical problems, there must be an active collaboration between the rural communities and the electrical firms, as also between the farmers, the communes, the departments and the State. This ideal of mutual support and co-operation is gradually gaining ground, was announced at the Bordeaux Congress (June 1922), was prominent at the Regional Congress at Montpellier (June 1923) and finally constituted the most important conclusion of the Lyons National Congress (October 1924). (R. PREAUD. L'électrification des campagnes. *Revue scientifique.* Special number published on the occasion of the White Coal Exhibition and Congress at Grenoble, Paris, 1925.

1028. **Tunis : Pig-breeding in Tunisia.** — This is successfully carried on in the centres of Tabarka, Tunis, Biserta, Deja and Souk-el-Arba. At Hamman-Lif a building has been put up for elaboration of pig products. The breeds of pigs to which attention is being given have been imported from Algeria, Malta and France and are reared on the local produce : potatoes, carrots, sugar beets, maize, barley, figs, acorns, sorghum, etc. (*Les Cahiers Coloniaux de l'Institut Colonial de Marseille*, No. 223, Toulouse, 1925).

1030. **Great Britain : Yeoman II Seed Wheat.** mention of which has already been made in this *Review* (Vol. III, 230, 1025), was distributed as arranged by the National Institute of Botany, Cambridge, the amount delivered of the new wheat being 2480 quarters. The price was fixed at £ 6.6.0 per quarter less 5 % discount for each. (*Journal of the Board of Agriculture*, Vol. XXXI, No. 11., 1069, London, 1925).

1031. **Sugar Beet from Field to Factory,** by R. N. DOWLING (formerly Agricultural Adviser to the National Sugar Beet Association). A concise and practical handbook written by one who has had a wide experience of sugar beet, both in England and on the Continent, and can envisage the matter from the farmers' point of view. *Contents* : Forword by Sir DANIEL HALL, K.C.B., F.R.S. ; soils, rotation, cultivations, manuring, yield, implements, cost of production, sugar beet pulp or slices, diseases and pests, production of beet sugar. Pages 72, illustrations 8 ; price 2s. 6d. Publishers : ERNEST BENN Ltd., Bouverie Street, London, E. C.

1032. **Great Britain : Improved Incubators.** — A British electrical engineer, Mr. LEWELYN B. ATKINSON, is of opinion that in the ordinary incubators the eggs are heated too nearly alike on both sides, while under the sitting hen there is a difference of 14 to 20 degrees between the top of the egg which is in contact with the hen's body and the lower surface of the egg which is in contact with the floor of the nest. He has tried the experiment of putting a thin sheet of india-rubber over the eggs in the incubator. By this method in an incubator which has rarely given above 55 per cent. of the eggs placed in it the percentage was raised to over 95 per cent. of the fertile eggs. Dr. M. A. JULL, poultry expert of the U. S. Department of Agriculture, says that the

ATKINSON experiments may have great significance for the American poultry business, which might draw an increased profit of several millions of dollars from the discovery. One of the most important factors of cost in the poultry business is the mortality of the chicks, and Dr. JULL is of opinion that the results of ATKINSON'S experiments should be checked and tests made to determine their practical application. (*Science*, Vol. LXI, No. 1578, 1925).

1033. **Great Britain: The Manufacture of Synthetic Ammonia at Billingham.** — A guarantee of £2,000,000 has been made under the *Trade Facilities Act* as new capital for Synthetic Ammonia and Nitrates Ltd. The works at Billingham will be extended to four or five times their present size and the output, now 120 tons of ammonium sulphate daily, will then approach 800 tons a day. Great Britain is now by far the second largest producer of synthetic ammonia, Germany still coming first. The factory at Billingham has only been fully at work since the spring of 1924. The process used is a modification of the HABER process. (*Chemistry and Industry*, Year 44, No. 21, 1925).

1034. **A Commercial Atlas.** — A new Commercial Atlas on a large scale has been published by GEORGE PHILIP and SON and T. S. SHELDRAKE, under the auspices of the Association of British Chambers of Commerce (*Association of British Chambers of Commerce* and *The Trade and Engineering Supplement of "The Times"*). It is a monumental work which represents the achievement of a great scheme of practical utility and the result of immense labour. It is of large size, and contains 168 coloured maps, besides diagrams and explanatory text. This is the first time any publisher has attempted the immense task of preparing a complete survey, alike systematic and exact, of the economic resources and of the commercial and industrial activity of the whole world under the form of an atlas.

Of the five parts, the first contains maps and diagrams forming an introduction so to speak to the other parts: distances, mountain systems, principal markets of the world, exchanges, fairs, exhibitions, hydraulic power, electric power, meteorological maps, etc. The second part deals with communications and transport. The water ways of the world are shown in large double page maps, and there are various maps dealing with the different navigation companies. The third part includes detailed maps of the chief products of the world in their various commercial and industrial relation (cereals, forage crops, oil-yielding plants, textiles, etc. and also the different stock breeding industries, production of furs, skins, feathers, and finally the various mineral products of the world. The fourth part is devoted to the commercial development in its manifold aspects, of the different main regions of the world, and graphic representations are given by means of coloured maps of the reserves of animal, vegetable and mineral wealth. The last part is a commercial compendium of the various products including even the minor ones and the whole is concluded by an alphabetical index referring to the *Dual Classification of Commodities*. (*Chambers of Commerce Atlas*. George Philip and So Ltd. 32 Fleet Street).

1035. **Italy: The Nitrogen Problem.** — This problem has been the subject of special examination by the Technical Commission for the Improvement of Agriculture (*Commissione tecnica pel miglioramento dell'agricoltura*) which after a long debate passed a proposal of Prof. A. MENOZ, inviting the Govern-

ment to press forward the developement of the Italian nitrogen industry and to grant all facilities for the works which might be considered requisite.

The Commission also expressed the view that when the industry should need support in view of foreign competition, a premium, or bounty, of suitable proportions would be preferable to protective duties. (*La Terra*, Year 1, No. 6, Bologna, 1925).

1036. **Holland: Potash.** — In view of the decision of the Dutch Government to work the potash deposits at Winterswijk, near the German frontier, it is of interest to note that the president of the German Kalisyndikat has founded, in association with Dutch financiers, the N. V. Kaly-Syndicaat at Amsterdam, to prepare, sell and obtain potash and other fertilisers and mining products. The company which has a capital of 100,000 florins, owns land and works that previously belonged to the German Kalisyndikat. (*Chemistry and Industry*, Year 44, No. 15, London, 1925).

1037. **Pomology and Pomologists.** — In the annals of the Swedish Pomological Society for 1925 (*Sveriges Pomologiska Förenings Årsskrift*) M. CARL G. DAHL publishes a historical monograph on pomology and pomologists, from Graeco-Roman times to the present day. The account is full of interesting information not generally known and there are a number of illustrations taken from old prints.

Journals and Reviews.

1038. **Austria: An Agricultural Market Gazette.** (*Niederösterreichische Landwirtschaftliche Marktzeitung*). — In the first years of its existence the Lower Austrian Chamber of Agriculture (Vienna I, Stallburggasse 2) published every Thursday a market gazette, which was sent out to all the communes. These gazettes which were printed on a small sheet were intended to keep the farmers informed of the prices of grain, live stock, concentrated feeding stuffs, milk and sugar. They were put up in public places so as to be seen by everyone. They were of course concise and could not contain information on the general position of the markets, or news of the stock markets. From 1 January 1925 the Lower Austrian Chamber of Agriculture has published the *Niederösterreichische Landwirtschaftliche Marktzeitung*, which contains the following parts: a leading article dealing with important questions in relation to the agricultural markets; shorter articles on the same subjects, practical advice on the purchase of various requisites, comparisons between the composition of materials placed on the market and their prices, notes on admixtures, adulterations, new legislative measures, results of statistical enquiries, etc. The daily market lists of the various Austrian markets are added in the form of tables and notes on the general position of these markets.

Particulars of the forthcoming cattle markets follow, and the gazette also makes a special announcement of the information which the farmers send in for insertion as to purchase or sale of a given material or product. The most important information on prices and position of markets are repeated subsequently on a special sheet, so as to be conveniently posted up for the use of the whole community. The Market Gazette is published by the Lower Austrian Chamber of Agriculture with the support of the agricultural [illegible] of the

various centres. The editor is RUDOLF KLEIN, inspector of the Chamber of Agriculture. The Gazette appears weekly, price 4 schellings a year for Austria (1 schelling = 10,000 Austrian crowns); 35 Czecho-slovakian crowns, or four and a half marks for Germany.

1039. **Austria: The "Landwirt".** — The Lower Austrian Chamber of Agriculture, which came into being by the law of 22 February 1922 had published "Mitteilungen" at irregular intervals. The periodical had no great circulation and contained merely brief official communications or mention of important measures. From 15 January of this year the *Landwirt* has been coming out in the middle of each month, as a quarto publication of 36 to 48 pages, and serving as the special organ of the Chamber of Agriculture. It contains the official communications already mentioned, reports of various agricultural and viticultural societies, which do not publish their own periodical and in addition special articles on agricultural policy, taxes, arboriculture, fruit-growing, viticulture and wine making, protection of plants, stock-breeding, cultivation of alpine pastures, etc. A short review of current events accompanies every special heading, each of which is carefully edited by the reporters of the Chamber of Agriculture. There is a section also for replies to requests for information.

The concluding article of each number of the *Landwirt* is informative and a given subject is explained in the clearest possible manner: e. g. in No. 1 the value of fertilising; in Nos. 2 and 3, insects useful to farmers, etc. The editor is the Government Advisor JOSEF LOSCHNIG, and the paper is published by the Lower Austrian Chamber of Agriculture, Vienna I, Stallburggasse 2. In the interest of the encouragement of agriculture, the price is very low: it is two and a half schellings yearly for those farmers who are electors of the Chamber of Agriculture and five schellings for the members of societies which work in cooperation with the Chamber.

1040. **Austria: The Vienna Centralblatt für das gesamte Forstwesen.** — This paper has completed its quincentenary. The first number appeared in 1 January 1875 owing to the activity of the veteran teacher ROBERT MICKLITZ, then Chief of the Austrian Forestry Administration. He was ably supported at that time by Prof. G. HEMPEL, and both workers had the valuable assistance of the firm of publishers FAESY and FRICK (now the FRICK Company) In 1083 the editorship was assumed by Prof. v. SECKENDORFF and from that time the periodical became the organ of the Mariabrunn Forestry Experiment Station (Forstliche Versuchsanstalt). When at a later date the work of editing was undertaken in part by Prof. CIESLAR, the review became merely the official organ of the Chairs of Forestry at the Vienna Higher School of Agriculture.

1041. **A New Brazilian Agricultural Review.** — The first number of this Review, which appears monthly under the title of *Ceres*, was published in São Paulo last May. It is above all a periodical of propaganda and agricultural measures. Dr. CARVALHO BARBOSA and Dr ROGERIO DE CAMARGO are the technical directors. The first number contains a report on the agricultural experiments carried out in the country for the farmers of São Simão, in 1923 and 1924, with the wheat of "Monte Claros", variety native to Minas Geraes, grown in the municipality of Monte Claros, from which it takes its name.

1042. **A New French Review on Present Day Problems in Agriculture.** — Entitled *Les Fastes de l'Agriculture* (The agricultural Calendar), and directed by Ing. Agr. J. H. RICARD. Its object is to present every year a complete picture of the agricultural events of the past year and to explain the principal questions of present day agriculture. The number for 1925 contains articles on the different branches of rural production and on important national and international questions (fiscal, customs, etc.) which are of interest to agriculturists. It contains numerous illustrations and graphs. The Review costs 4.50 frs. a number.

1043. **The Paris Scientific Review.** — On the occasion of the Congress and the Exhibition of white coal at Grenoble (May to November 1925), was published a special number entirely devoted to the various aspects of specially applied hydraulic energy. The number, well illustrated, contains an introduction by A. RATEAU, member of the Academy of Science, and a chapter on the Grenoble Exhibition, edited by Ing. A. BLOCH. There follow various chapters of a general order : on the causes of energy (Prof. A. FOCH), on the financial problem of fossil coal (G. TOCHON) on the regulations of hydraulic forces (Ing. J. DUPIN), and a retrospective glance at the hydrodynamic studies in France (Prof. JOGUET). Lastly, there follow the chapter on applied technology : hydraulic turbines (Ing. D. EYDOUX), the electrification of the country (Ing. R. PREAUD), the electrification of the railways of Southern France (Ing. MASSONNEAU), the distribution of electric energy (MONMERQUÉ), electricity and the electrification of the railways (H. PARODI).

1044. **English Avicultural Annual.** — The Annual for 1925, published by the English journal *The Feathered World*, forms this year a fine illustrated volume (*The Feathered World Year Book*), of interest to all classes of aviculturists. Price 3/6. For particulars apply to the Editor of the above named journal, 9, Arundel Street, Strand, London, W.C. 2.

1045. **Holland : Il Nederlandsch Weekblad voor Zuivelbereiding en Handel** (Dutch weekly periodical for the cheese industry and commerce), organ of the Dutch producers and merchants of milk foods, has published a Jubilee number (Year 31, No. 6, 12 May 1925) on its 30th anniversary. An article by Prof. Dr. H. M. KROON contains recollections on the foundation of the periodical, and in another article there are short accounts with portraits of persons who have taken the lead in the science and practice of cheese-making : Prof. B. VAN DER BURG of the Higher School of Agriculture in Wageningen ; Prof. F. W. I. BOEKHOUT, Director of the Bacteriological Section of the Government Agricultural Experiment Station of Hoorn ; Prof. E. HEKMA, Director of the Physiological Section, also of the Hoorn Station ; Prof. W. KEESTRA, Director of the Government School of cheese-making in Bolsward ; and of consulting cheese experts J. J. C. AMENT, Ing. P. N. BOEKE[illegible] Dr. A. G. BREEN, H. B. HYLKEMA, Ing. A. K. HYLKEMA, J. J. [illegible] Ing. W. J. HUISMAN, Dr. L. T. C. SCHEY, J. J. WINTERMANS, Ing. W. [illegible] DEMA, C. ZWAGERMAN.

1046. **Annual of the Swedish Pomological Society.** — Mr. EMILE JOHANNSON has drawn up a useful general index of the annual [illegible] *Pomologiska Förenings Årsskrift* for the years I-XXV [illegible]

according to subjects It is published in the two first quarterly numbers of the 1925 issue of the same Review.

Personal.

1047. ARISTIDES AGRAMONTE, professor of Bacteriology at the University of Havannah and delegate of Cuba at the Third Pan-American Scientific Congress, was given an honorary degree in science by the University of San Marcos, Lima, Peru and was also nominated corresponding member of the Peruvian Medical Academy.

1048. The Maine (United States) Federation of Agricultural Associations will offer the University of that State a bronze plaque to the memory of RUTILLUS ALDEN to whom the progress of agriculture in Maine owes much.

1049. The Royal Horticultural Society, London, has awarded the LINDLEY Gold Medal to ALBERT C. BURRAGE of Boston, president of the Massachusetts Horticultural Society and of the American Orchid Society, for his show of New England plants at the Chelsea exhibition.

1050. THOMAS L. CASEY, retired colonel of the American army, who died some months ago at Washington, D.C., has left his collection of coleoptera and his library of entomological works as well as malariological collection and library to the National Museum of the United States. The collection of coleoptera contains 15,000 species, about a third being typical.

1051. The American Association for the advancement of Science has granted a reward of 500 dollars to Dr. L. E. CLEVELAND of the Johns Hopkins School of Hygiene and Public Health, for one of his works on the physiology of white ants and their parasites.

1052. A celebration took place of the 60th birthday of Dr. MAX CREMER, professor of physiology at the Veterinary Institute of Berlin University. The *Biochemische Zeitschrift* dedicated a special number to CREMER on that occasion.

1053. An "Institute of Radium" will be founded by national subscription in honour of Madame CURIE at Warsaw (Poland), birth-place of that great scientist.

1054. Dr. MARTIN H. FISCHER of Cincinnati University was elected corresponding member of the Czecho-Slovakian Botanical Society for his services to botanical Science.

1055. Dr. KURT GOTTLOB, noted for his technico-scientific works on rubber, died in Lower Austria on the 23rd of April 1925.

1056. Professor BATTISTA GRASSI died in Rome on March 4th 1925, aged 71. The life of the illustrious biologist was one of continual devotion to scientific research and many of his discoveries will remain classic owing to their fruitful application in the clinic and in the field of agriculture. In his early years, after having graduated in medicine and surgery (1878), he published his first researches on *anguillula intestinalis*, on *Ascaris lumbricoides*, on *Taenia nana*, on *Oxyurus* and on *Trichocephalus*. At the age of 29 he was elected professor of Zoology at the University of Catania (1883), and he rose to great fame through his studies on termites as well as for other valuable work. Called to Rome in 1895, he conducted and concluded his successful and well known researches in malariology in collaboration with BIGNAMI and BASTIANELLI which led him

to identify the Anopheles as transmitting agents of human malaria. As a result of these researches he had already forestalled Ross in the discovery of the *Proteosoma precox*, the parasite of malaria of birds.

His works on phlebotomy and goitre proved fruitful on the scientific side. No less fame came to GRASSI for the admirable investigations he undertook or caused to be undertaken in his laboratory by diligent collaborators (FOA, GRANDORI, BONFIGLI, TOPI) on phylloxera, which were collected in 1912 in a large volume of over 450 pages, with 19 plates, a work which BÖRNER called monumental and which was mainly the results of his researches on the phylloxera of vines.

The various branches of zoology treated by this celebrated investigator were handled with remarkable breadth of view. GRASSI was a distinguished member of 24 foreign and of all the principal Italian Societies and Academies. His discoveries gained him the DARWIN medal of the *Royal Society*; the MARY KINGSLEY medal of the Liverpool *School of Tropical Medicine*; the Paris award of the Madrid International Congress of Medicine; the VALLAURI award of the Torino Academy; the BALBI award of the Lombardo Veneto Institute; the royal award of the Academy of the Lincei; the Beekeepers Gold Medal; the Italian agriculturists Gold Crown. (In honour of BATTISTA GRASSI. Publication issued by the Committee of the "*Fondazione per gli [illegible] malattie parassitarie*"; 1 Vol., 8°; pp. 108, published, Rome, 1925. C. CITRONEI. *Battista Grassi.* Abstract from the *Monitore Zoologico Italiano*, Year XXXVI, n. 4-5, Siena, 1925).

1057. Professor ALBIN HALLER, director of the Institute of Physics and Chemistry of the Sorbonne, died on the 1st of March last, at the age of [illegible]. He was renowned for his numerous works on camphor and bye-products, on anthracene and bye-products, menthol, organic acids, fats, waxes, etc.

1058. The T. KOCHER award of Berne University was conferred on Professor BALTZER to enable him to continue his researches on heredity and on sex predetermination.

1059. The Confidential Government Counsellor, Professor Dr [illegible] KROEMER-LISCH, well known for his studies in enology and Director of the Higher School of Agriculture and Brewery in Weihenstephan, on April 1 [illegible], completed 40 years of practical-scientific activity. In 1910 he was nominated Director of the Agricultral Experiment Station of Colmar in Alsatia, and was expelled in December 1918. In May 1921 he was chosen to occupy the position of Director of the School of Weihenstephan.

1060. The well-known viticulturist E. MAROGER, member of the Agricultural Office of the South, of the Council of Administration of the National School of Agriculture of Montpellier, etc. died in France. His experiments on the cultivation of vineyards are noteworthy. The last number of the present Review has just published one of his articles on this subject. A few days before his death he was invited by the Argentine Government to [illegible] conferences on viticulture.

1061. Dr. G. MARQUARD, Professor of Chemistry and Biology at the Maria Theresa Royal School of Munich, celebrated his [illegible]

1062. The death is announced at the age of [illegible] of [illegible] SZALTNA, Professor of the Higher School of Agriculture at [illegible]

1063. The Privy Counsellor of Commerce, G. von Sedlmayr of Munich Director of the Scientific Station for the Brewing Industry, celebrated his 75 birthday on 5 April 1925.

1064. French Agriculture has lost one of her most active and best known members by the death of Viscount Jules Faydit de Terssac, member of the *Conseil Supérieur d'Agriculture* since 1905 and president of numerous agricultural and stock breeding societies.

1065. Kwok wah Shau of the Chinese province of Haungshan, died on 14 July 1925. He is well known for his horticultural studies, particularly of lemons. With regard to the latter, he completed exhaustive investigations with Groff in the research of varieties resistant to canker, for the *Ling Nan Agricultural College* of Canton. The college has lost one of its best students in Kwok and will publish a full biography in a future number of the *Lingnaam Agricultural Review*. The *Agricultural Monthly* has already published an obituary notice, in Chinese.

Dott. G. V. R. Borghesani, *gerente responsabile*

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FOREWORD

The index arranged alphabetically is divided into five sections: 1) original articles; 2) proceedings of the International Society of Soil Science and of the International Seed Testing Association; 3) special activities of the Bureau of Agricultural Science of the International Institute of Agriculture; 4) agricultural intelligence; 5) plant diseases.

These two last sections are divided into two parts:— *a*) subject matter; *b*) authors; they contain both the references of the first three sections and of the current notices.

Under generic headings only information of a general character is given; information on special subjects is given under that special heading.

The four first sections have been compiled by Dr. Francesca Dorio, those on plant diseases by Professor Giulio Trinchieri.

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(A) INDEX OF SUBJECTS.

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Errata graviora et addenda.

(*International Review of the Science and Practice of Agriculture*, New Series, Vol. III, 1925).

Page 142, lines 32-34, read as follows the title of the abstract: *Investigations of soil rocks and their stratification in the Speier chart and on soils of the Kusel chart of the Bavarian Geological Map* 1 : 100 000.

" 595, lines 6 and 7, substitute the following quotation : BONDAR G., *Phtorimaea operculella* Zell. no Brasil. *Correio agricola*, Year II, No. 10, Pp. 292-294. Bahia, 1924.

" 595, line 29, instead of BARTHEL C. read BARBEY A.

" 838, line 38, instead of *milk and work* read *meat and work*.

" 898, lines 8 and 15, instead of *Southern Italy and the Insular Possessions* read *Southern Italy and the Italian Islands*.

" 913, line 13, instead of *Canada* read *Japan*.
line 14, instead of *Canadian* read *Japanese*.

" 954, explanation of fig. 194, instead of D = *density* read D = *curve of the mixture*; instead of K = *density* read K = *concentration*.

" 1022, line 4 of the table, 3rd column, instead of 11,18 read 18,18.

" 1058, line 27, suppress the word *Laon*.

" 1060, line 16, instead of *Jonboden*, read *Tonboden*.

" 1060 : after line 16 add : COMBER N. M. The Role of the Electronegative Ions in the Reactions between Soils and Electrolytes. — *Trans. Faraday Society*, XX, *p.* 567, 1925.

" 1070: after line 41 transfer and insert lines 45-48 of page 1071 and lines 1-19 of page 1072.

Plates LXXXIV (opposite to page 973) and LXXXV (opposite to page 974) : exchange the explanations of the figures 233 and 236.